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ABSTRACT

The conference featured 10 keynote addresses, over 30 invited papers, 5 major symposia, 5 field trips, and 73 contributed papers. These proceedings contain two major sections. The first section presents 10 of the keynote addresses and invited papers, most of which relate to the larger cultural aspects of the conference theme, "Crossroads, Society, and Technology." The second section consists of the abstracts of the 73 contributed papers. These are either the long (1500 word) abstract submitted by the author or the short abstract taken from the conference program. An alphabetical index by author is also included. Each entry is cross-referenced by educational level(s) and subject area(s). Subject areas include: (1) environmental education and citizen action; (2) culture and technology; (3) energy; (4) the Great Lakes; (5) economic effects of technology; and (6) international aspects and other areas. (JN)

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PROCEEDINGS
OF THE
12TH ANNUAL CONFERENCE OF THE
NATIONAL ASSOCIATION FOR ENVIRONMENTAL EDUCATION

CROSSROADS

SOCIETY AND TECHNOLOGY

1983
YPSILANTI, MICHIGAN

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Preface

This is a proceedings of the 12th annual conference of the National Association for Environmental Education (NAEE). The conference was held at the Hoyt Conference Center of Eastern Michigan University from September 30 to October 5, 1983. The conference featured ten keynote addresses, over thirty invited speakers, five major symposia, five field trips, and over seventy contributed papers. Over two hundred people attended the conference from twenty-five states and several foreign countries including Australia, Canada, India, and Switzerland. Many of the presentations were related to the conference theme "Crossroads, Society, and Technology" - a theme intended to take full advantage of the Eastern Michigan site. For instance, the field trips included visits to the Henry Ford Museum, G.M. Proving Grounds, and the Fermi II Nuclear Reactor.

In 1983, the Board of Directors approved a change in the publications of the NAEE. *Current Issues,* the annual publication of the NAEE, has been changed from a publication offering "refereed" and "non-refereed" sections to a stricly refereed publication - the new *Monograph* series. This was done to enhance the quality of the series and to accommodate the high demand for refereed publications.

The non-refereed section of *Current Issues* has now evolved into this conference proceedings. The intent of the NAEE Board was to: 1) change the pattern of NAEE publications to a format more commonly used by professional associations, 2) provide a more complete record of annual conference activities, 3) improve the format of publications for all levels of environmental education, and 4) improve communications among environmental educators both at home and abroad.

This proceedings contains two major sections. The first highlights the keynote addresses and invited presentations of the speakers who provided or submitted written copy to the editor. The second section consists of long abstracts of contributed papers (limit 1500 words) submitted to the editor. If a long abstract was not submitted by an author, the short abstract (from the conference program) is included to complete the record of the conference.

It is important to note that many of the original manuscripts have been slightly altered by the editor for reasons of content, clarity, brevity, or translation to American English. Copies of the original manuscripts may be obtained from the authors.

I would like to thank Marty Hetherington of Michigan State University, Craig Davis of Iowa State University and Arthur Sacks of the University of Wisconsin for editorial and policy support. I would also like to thank Diane Baldwin and Iris Gould for production of the manuscript. Finally, I would like to thank Joan Heidelberg for her effort in publishing and distributing this proceedings.

John H. Bald

John H. Baldwin
University of Oregon
April 1984

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I. Keynote Addresses and Invited Papers.

1. Keynote Address

Rappaport, Roy A. "Adaptation and Maladaptation in the Evolution of Culture, Technology and Society." Chair, Department of Anthropology, University of Michigan, Ann Arbor, Michigan 48109

I shall be concerned with the changing relationship of culture to humanity in the course of evolution and further concerned with the problems arising out of this change. My expression suggests a distinction between culture on the one hand and humanity on the other when, in fact, most cultural anthropoligists would take the possession of culture to be definitive of humanity. Indeed, culture is as much a part of humanity as are its species-specific dental characteristics, its spinal column, its central nervous organization. Although our knowledge is incomplete and our usage is vague, and although we generally work on more specific and more tractable problems, I think most anthropologists would agree that our hominid forebears became what might loosely be called "fully human" when they became cultural.

The term "hominid" refers to members of the taxonomic family Hominidae, a family that includes both what are called the "Australopithecinae" and the genus Homo. The Australopithecinae, who were fully bipedal but had brains about the size of apes' or a bit larger -- around one-third the size of ours -- flourished from about four to a little less than two million years ago in Africa. An overwhelming majority of anthropologists take them to be ancestral to the Genus Homo. The fossil record as it presently stands indicates that Homo erectus (previously designated Pithecanthropines) appears in Africa about 2,000,000 years ago, and spreads throughout the old world, becoming increasingly modern through time, transforming into what is said to be Homo sapiens 200-300,000 years ago. Modern usage includes Neanderthals within the species, sapiens.

There is considerable disagreement as to when in the course of hominid evolution culture may have emerged. Of course, the emergence was gradual. It does seem clear, however, that the Australopithecinae were tool using and tool making (so, as a matter of fact, are contemporary wild chimpanzees) and most authorities believe that their mode of communication was at least as elaborate as that of contemporary apes. There are, nevertheless, reasons to believe that something revolutionary was involved in the appearance of Homo. Such a revolution is strongly suggested by an expansion of cranial capacity from the 300-600 c.c. characteristic of Australopithecinae, a range that approximates contemporary apes, to the size characteristic of Homo erectus: 800-1200 c.c., a capacity that overlaps with the range of modern humans. It is plausible to believe that cranial expansion had to do with culture.

I have not yet indicated what I mean by "culture." Culture is a key term in American Anthropology, and like all key terms it is vague. A variety of usages prevails. My usage follows Leslie White's, who defined it as follows:

> Culture is the name of a distinct order, or class, of phenomena, namely those things and events that are

> dependent upon the exercise of a mental ability peculiar to the human species that we have termed symbolizing (i.e., the invention and use of symbols), it is an elaborate mechanism, an organization of ways and means employed by a particular animal, Man, in the struggle for existence and survival (1949).

This definition requires some discussion. First, culture is an order of phenomena based upon symbols. But symbol is another of those words. When he used the word "symbol" White was not talking about anything as arcane as what Freudians or literary critics mean by the term. He was following the nineteenth century philosopher Charles Saunders Peirce who defined symbols as signs which are only conventionally related to that which they signify. In this usage words are the fundamental symbols. That the label for the animal with four legs, long ears, and a cold nose is "dog" is mere convention. It would just as well be called "hund" or "chien," and in fact it is.

Peirce contrasted symbols with other types of sign. First, there are icons. Icons bear formal resemblance to that which they signify. A map, for instance, is an icon of a territory. In this usage a so-called "phallic symbol" is not a symbol at all but an icon. Second, there are indices. Indices are caused by, or are a part of, that which they signify: a rash is an index of measles; a scream indicates pain.

The great proponderance of animal communication may be indexical, although some animals are clearly capable of learning some symbols and what may be symbol use has been observed in some wild animal populations. But only humans, so far as we know, are capable of the more elaborate symbolic constructions we call sentences. That is, only humans possess any degree of grammatical ability. Symbol + grammar = language, and the implication of White's definition is that culture is based upon language. It is founded upon language but includes more than language. It includes all of those things that would literally be inconceivable in the absence of language -- religion, of course, and art, and science, and also complex divisions of labor, complex social and political organization, and the proponderance of our technology. Chimpanzees use sticks and even modify them slightly and young chimps learn to make and use such implements from their elders. But what can be learned about technology without language is very little. Technology is contingent upon language and is a component of culture.

I have asserted that the use of language makes possible for those who possess it ways of life inconceivable to creatures who don't possess it. Consider first that with language it is possible for communication to escape from the here and now to report upon the past and distant, and, in some degree, to order the future. Obviously this facilitates elaboration of the division of labor, making more precise coordination and planning possible. For example, it becomes possible to communicate messages such as, "You hunt up the valley past the three boulders, I will take the children and collect roots down near the swamp and we'll meet at dusk at the place where we camped last winter -- under the big tree by the rapids in the stream flowing off the small peak." This is a degree of planning impossible without language, and this ability must have been selected for strongly. As such it would have developed relatively rapidly. To say that language ability must have been strongly selected for is to say that the anatomical structures underlying it were strongly selected for. I would guess that the cranial expansion that marks the transition from Australopithecine to Homo stages of human evolution is to be associated with the development of this ability.

But the sort of planning just noted isn't all that you can do with language. With language, discourse can escape from the here and now to enter not only the actual past and distant, and the realm of future action. It can also enter into the might have been, the should have been, the never will be, the could be, the should be -- into, this is to say, the realms of the desirable, the moral, the proper, the possible, the impossible, and the imaginary.

I use the term "discourse" here rather than "communication" because discourse, at least in archaic usage, referred to the process or power of reasoning as well as to exchanges of information between individuals. There is an expansion of magnitudes in the scope of thought. This expansion and the ability to communicate its products -- ideas, conceptions, evaluations -- to others underlies the adaptation of the species, and the adaptations of the various societies into which the species is ever dividing and redividing itself. It is an important component of our capacity to conceive and bring into being technological innovations, and it underlies our ability to conceive and construct alternative social arrangements. Expansion of our conceptual and communicational abilities is central to our adaptation.

The term "adaptation" refers to the processes through which living systems maintain themselves -- maintain internal equilibrium or "homeostasis" in the face of the perturbations continuously impinging upon them from ever changing environments. Adaptive responses may involve either temporary changes of state or permanent changes in structure. Flexibility, it is obvious, is crucial to adaptation. The flexibility resulting from our possession of culture is unparalleled among animals and has made it possible for us, a single interbreeding species, to adapt to the great variety of environments the world presents to us.

White emphasized two points in his definition of culture, as have I. First, it is symbolic in nature. Second, it is central to human adaptation and to the human way of life generally. He conceived of it, however, as something so momentous that even the latter characterization did not do its significance justice. He took the appearance of the symbol to be the most important novelty to have appeared not only in hominid evolution but in the evolution of the world since the appearance of life itself. In my view he exaggerated. I think it's no more than the most important innovation since the appearance of sex, to which it may be directly compared, for the appearance of both increased the flexibility and speed of evolutionary processes enormously. Culture is, thus, not merely an evolutionary novelty of significance only to the species to which it appears, but an innovation in the evolutionary process itself. Its significance transcends the species in which it occurs as it reaches out, so to speak, to encompass the world which that species increasingly dominates. We come now to problems unique to culture.

There is no doubt in my mind that culture emerged, as did bipedalism, as part of the adaptive apparatus of the evolving hominids, as emphasized in White's definition. It continues to be central to that adaptation. But such a characterization of culture is hardly sufficient to encompass its implications. I would note at the outset that there are problems intrinsic to its very virtues. I have dealt with two of them elsewhere (1971, 1976, 1979a, 1979b). First, when the sign is no longer intrinsic to what it signifies (a relation definitive of symbols), lying is facilitated. Trust and trustworthiness, truth and falsehood, deceit in all its forms, become problems. Second, the ability to conceive of alternatives to the social conditions prevailing, an ability magnifying the flexibility of the species, at the same time increases possibilities of disorder, making the maintenance of social order an ever-potential problem.

Although these first two problems are germane, I have time to follow the implications of only a third today. It is this. I have said that the elaborated symbolic capacity represented in language *permits* thought and action to excape from the hard physical actualities of here and now to discover other realms, the realms, among others, of the might be, the could be, the should be, the realms of the possible, the desirable, and the valuable. I have emphasized that language *permits* such thought. That is not quite correct. It *requires* such thought. Humanity is a species, this is to say, that can live *only* in terms of understandings and meanings it itself constructs. The world in which we live is not a world constituted entirely by tectonic meterological and organic processes. It is also in a considerable degree symbolically constructed out of socially agreed upon understandings. Our world is made up of symbolically conceived and socially established institutions and values as well as of naturally constituted rocks and trees and oceans. It is in terms of these understandings, which include not only theories about how the world works but also about what is moral and valuable, that we act in the world.

I have said that the characterization of culture as central to our adaptation, while correct, does not adequately represent the relationship of culture to the organisms among whom it is found, and it should now be apparent why. For one thing, culture is not only the way we adapt to the world as it is, but it is also our means for remaking the world. For a second -- related, but a little different from the first -- we come to be governed by the understandings we have constructed. Instead of being served by those understandings, meanings, and values, we find ourselves in *their* service. In the course of evolution there is, as it were, an inversion of the relationship of the cultural and organic components of the species. Our early evolution and culture's place in it can probably be adequately accounted for in Darwinian terms. In Darwinian theory selection is a matter of differential reproduction. Organisms and groups of organisms with greater cultural capacities outbred others. But such understanding of the relationship of culture to organism doesn't tell the story adequately for later stages in human evolution. It is obvious that some of the meanings we construct -- religious meanings are notorious in this regard -- are so strongly held, or rather hold us so strongly -- that we will die for them. So it is misleading to say, simply, that culture is central to our adaptation. It has, as it were, outgrown that role.

Let me summarize the situation. The world is in part constructed by our understanding and actions. It is, this is to say, full of conventions that did not come into existence through the action of the wind, waves, chromosomes, or movement of continents, conventions like marriage, bicameral legislatures, gods, truth, honor, deceit, kings, scientific theories, and moral dicta. The world is in part what we understand it to be simply because we ourselves created much of what is in it. But only in part. It also continues to be constructed by natural processes, and all cultural constructions remain as contingent upon those natural processes as they were when a well-sharpened stick was state-of-the-art technology. The operation of natural law, unlike the force of convention, is not contingent upon our acquiescence or even upon our understanding. Natural laws operate even when we are in ignorance of them. Gravity and natural selection operated before there were minds to contemplate them or even senses to experience them.

In sum, humanity is a species that can only live in terms of meanings it itself must construct in a world devoid of intrinsic meaning but subject to causal laws, knowledge of which will never be complete. We are, unlike any other species on earth, caught between natural law and constructed meaning. This is the human situation -- and it is a tenuous one -- because there is nothing to prevent us, in our efforts to construct the understandings that will, in turn, guide us, from constructing self-destructive or even world-destructive follies.

Not only is our situation tenuous, but it becomes increasingly tenuous in the course of evolution. In the course of cultural evolution social and technical developments have emerged which, while constituting what we understand to be advances in some areas have set potential problems in others. These problems, which in some instances have not surfaced for centuries, are problems of understanding in a dialectic with social and technical developments. Let me speak of the division of labor above the household level. Its elaboration has greatly increased the efficiency of society and has made possible amenities otherwise impossible to produce. It has also increased the amount of information that societies can store and process. At the same time, however, it establishes special interests, fragments knowledge and overspecializes individuals. It provides those individuals with views of the world which, from the vantage point of their specialization, are likely to be inadequate to grasp the world's wholeness.

Let us next take all purpose money, which came into existence several thousand years ago. It greatly facilitated the elaboration of the division of labor and the development of trade and was thus an important component in the emergence of that complex organization of society called "civilization." What are not generally understood are its semiotic implications. Money threatens meaning. This takes a little spelling out.

Meaning is in some degree founded upon information in the technical sense. Information is associated with distinction. The meaning of words comes from distinction or contrast. "Light," for instance, gets its meaning from contrasts with "dark" and "heavy." Similarly, "animal" contrasts with "vegetable." Distinction reflects the condition of the world. The world, this is to say, is full of qualitatively distinct things and we need a great many qualitatively distinct things to survive. You can have a surfeit of protein, but if you don't have vitamin C your teeth will fall out. All the protein in the world won't make up for it.

The problem of money and meaning is simply this. When it is used as a standard of value it dissolves the distinctions between qualitatively unlike things simply by submitting them to a common metric, such as dollar value. The application of a common metric to qualitatively different things reduces qualitative distinctions to the status of mere quantitative differences. Decisions concerning these things no longer take their distinctiveness into consideration. What's the difference between a forest and a parking lot? The cogent answer becomes something like "$10,000 per acre." Questions concerning species diversity, transpiration rates, and primary productivity not only become irrelevant, they can't even be asked. Decision is simply a matter of what is aptly called "the bottom line." The understandings of the world given to us by money are impoverished.

Then there is technology. The virtues of high power technology are justly celebrated but, as every schoolboy knows, some of its products are demonic. Small mistakes can now lead literally to annihilation with -- take your choice -- nuclear bombs, biological weapons, or poison gas being the agent. This is the great and immediate danger, of course, but there are others which are less obvious. As technology becomes increasingly powerful in a physical sense, it can, of course, transform the environment ever more radically. Moreover, the institutions surrounding it become increasingly powerful economically. In dominating the economy they dominate society, and men come to serve them. Ultimately these institutions, which are run not so much by owners as by managers, come not to serve the end of profit as much as they do the simple end of keeping themselves going -- which is to say, keeping the machines at their hearts running. The needs of machines are simple and voracious. It conforms to the logic of an industrialized world run according to the conventional understandings of economics and money to rip the top off a complex ecosystem, like West Virginia to get at a single simple substance, coal.

It should be clear that I am not claiming that we choose meanings that are lethal to us and to the world out of perversity. Such meanings arise out of our historical circumstances. It seems to me, nevertheless, that our understanding of the world becomes increasingly flawed at the same time that our ability to damage the world is ever being magnified. I don't know the cure. It would be absurd to attempt to correct the problems of money and high energy technology by doing away with them. We are, however, without a general theory of correction. What is called "problem solving" creates more problems than it solves because it rectifies symptoms, proposes they are problems, and doesn't get to the structural disorders underlying them. Elsewhere I have proposed that there is a limited family of such structural disorders generating the innumerable symptoms we call problems: the environmental problems, the unemployment problem, the Central American problem, etc. (Rappaport 1976, 1977, 1979c). We must find ways to restore adaptiveness to systems afflicted by such maladaptive disorders. We are teachers. We talk and hope people will listen. We can, perhaps, give our students an alternative vision or understanding of humanity, an alternative to the dominant view of man as Homo economicus.

In this respect I am reminded of the conception of Logos in early Greek thought. The Logos, in what we know of Heraclitus' thought, was a rational order underlying the universe. The most fundamental characteristic of the Logos was oneness, the basic Heraclitian fragment being "Listening not to me but to the Logos the wise agree all things are one." Other characteristics were Alethia -- truth; Harmonia, harmony in tension, and physis, the vitality of the natural.

Although it is the order underlying the universe it can be violated by human action. There is both wisdom and virtue in grasping the Logos -- or being grasped by it -- and following it, according to Heraclitus. But most humans don't follow it because they can't see it and are deluded by the Logos' enemy or opposite, Idia phronesis -- private reason, private interest. Idia phronesis' modern manifestation is economic rationality, a logic which sets humans against each other and against the world.

Although it is hidden, the human mind, according to Heraclitus, could, with great effort, grasp the logos because the order of the universe also orders the mind. To put this in the converse, the Logos can reach consciousness in the human mind and, so far as we know, only in the human mind. As such we are a very special part of the universe: We are the only way it has to think about itself.

I have said that we must live in the world in terms of understandings we ourselves must construct. We have some choice, this is to say, in the matter of how we view ourselves and our place in the world. It is more ennobling for us and for our students to conceive of ourselves as the world's consciousness than as economic men, and it makes clear our responsibility to the world of which we are indubitably parts.

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2. Invited Paper

Aldridge, Alexandra, "High Tech: Planning and Assessment." Department of Interdisciplinary Technology, Eastern Michigan University, Ypsilanti, Michigan 48197

I've been asked to make some remarks about the social impacts of high technology, and since high technology is a term many either dislike or find meaningless, let me begin by suggesting what, at least, I understand by it. If there is any meaning to the term, it is on the scale of technological sophistication. Examples that come to mind are from biotechnology, like monoclonal anti-body techniques; or from high energy physics, like laser devices; or from applied math and physics, like personal computers; or from mechanical and computer engineering, like visual, tactile robots.

If we look at programmable robots, we can say that the chores they perform, such as spray painting or looking for defects in parts to be assembled, may be mundane, but the device itself is sophisticated.

Beyond that "working definition" the most important point for our assessment purposes is to reaffirm an obvious fact: technology, high or low cannot be fully understood outside the social/economic context in which it is used.

This is true whether we are talking about the scratch plow of some 6,000 years ago which led to the first permanent human settlements, or about industrial automation which leads to increased productivity in the manufacturing sector.

We do not assume, however, that either the introduction of the plow or the robot made everyone happy. The young men of ancient Mesopotamia, the Nile Valley and the River Indus were taken away from the life of hunting and fishing in the wild which had occupied nomadic cultures in pre-civilized history. The plow domesticated them to the hard labor and routine of the farm.

A more familiar assumption to us is that industrial automation is not just responsible for increased productivity at General Motors or Toyota, but that at least at GM, robots have also led to unemployment ("technological displacement" is the euphemism) which, among the unskilled may be permanent.

The clear conclusion to be drawn from this is that *both* high tech *and* all the tech which preceeded it have made for a complex series of trade-offs between socio-economic advancement and disasters, large and small. Furthermore, these two alternatives historically have produced two antagonistic ideologies. Some of you know them by the James Robertson rhetoric (From The Sane Alternative, 1978): The HE, or Hyper-Expansionist group and the SHE, or Sane, Humane, Ecological group. I prefer to call them by what must be equally familiar terms in these circles, the "technophiles" and the "technophobes."

In the broadest sense these two groups are separated by their positions on the social and economic effects of technology: one emphasizes benefits while the other places blame. The technophobes, critics of both technological advancements and its advocates, have traditionally concentrated on three major themes: like Dickens and Doestoevski in mid-19th century and Theodore Roszak and Jacques Ellul in the 1960's and 70's they have:

1. criticized the business and industrial culture for internalizing images represented by technology -- images of efficiency, routine, neutrality, standarization. They have blamed business and industry for taking on technological values, values not shaped by human alacrity but by the machine itself.
2. from Dickens to Schumacher, they have blamed technology, not just for taking work away, but for "taking away the essentially human part of the work." (Now critics of high technology remind us of more than technological displacement, they point to those who do have the new office and factory jobs and who are stuck with the tedium of low level information processing or the tedium of microprocesser manufacturing (i.e. the mindless routine of inspecting chips under a microscope).
3. and of course, traditionally, technophobes have condemned industrial technology for devastating the physical environment.

In this last category, technophobes, acting as environmentalists have made a huge difference. But looking back over the argument of the technophobes from the 19th century to the present, we should bear in mind that in their concern for the dehumanizing effects of technology they have always been the minority voice, what Leo Marx called "the romantic counterpoint" to technological progress. Except for their winning scores as environmentalists, their influence has never been pervasive and they have never made more than a very small, usually negative impression on the business culture.

But clearly something has happened in recent years to change all that. Everywhere we look in American business and industry, the introduction of high technology brings with it into the company a few and surprising emphasis on the human aspects of technology. For all the social and economic problems which exist in the transition to a high tech society, we find considerable evidence of a major change in the business culture: (examples)

1. automobile manufacture: automation has brought Quality Circles to General Motors and Employee Involvement (EI) to Ford;

2. the Society of Manufacturing Engineers, in August 1983, organized a World Congress on the Human Aspects of Industrial Automation (Ann Arbor);
3. The most popular management training seminars are not just in Statistical Process Control and Statistical Quality Control but in "Human Aspects of Office Automation" and "The Role of Intuition in Management Strategies."
4. Stanford Research Institute (SRI International) has just published a five volume report for executives (for a mere $1,950.00) called *More Effective Management and Strategic Planning Using Values and Lifestyles*.

The question for social philosophers is *why* has the introduction of high technology into the worklife seemingly inspired this new emphasis in U.S. business and industry on human resources? Answers have been offered in books, papers, and articles by minds ranging in depth from Thomas Kuhn and Peter Drucker to Alvin Toffler and John Naisbitt (examples):

1. the impact of the 60's generation on the workforce with their need for autonomy;
2. the growing numbers of women in the workforce;
3. a transformation of consciousness linked to the debunking of mechanistic science;
4. lessons learned from the Japanese about worker incentives;
5. the breakdown of hierarchical management practices in high tech settings.

For whatever composite of reasons, a version of the revolution of consciousness has reached business and industry and it coincides with the emergence of high technology.

At the beginning, I suggested some identifying characteristics of high technology to which we might now add the following: high technology, as clean industry which, in some inceptions like robotics relieves people of dirty, onerous jobs, conveys a more *benign* image than the industrial technology of the past. The managers of high technology who are more conscious of human factors in a well-run business than managers of a generation ago, have absorbed some part of the message of the technophobe minority and with varying degrees of success are bringing technological caution into the mainstream.

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3. Invited Paper

Belote, Linda A. "Appropriate Technology in the Third World: Planning and Assessment." Michigan Technical University, Houghton, Michigan 48630.

In this presentation I will review appropriate technology and its promise and problems for the future of the Third World, using, in part, illustrations from the Andean Indian community of Saraguro, Ecuador, where my husband and I have done Peace Corps work and anthropolitical research for a total of five years between 1962 and 1981. (See Belote and Belote 1981, 1983)

In Small is Beautiful, E. F. Schumacher set out his vision of an intermediate technology to meet the needs of the poor, illiterate, unemployed and underemployed millions in Third World countries. It is a technology that is both (at once) ecologically sound, and humane. It is labor intensive rather than capital intensive, simple, so that it can be produced locally utilizing local resources, and low cost. Ultimately it was seen that intermediate technology would raise the quality of life for millions, decentralize the locus of economic control, and help bridge the widening gap between the poor and the wealthy, the rural and the urban, and the developed and less developed nations. It is to be a technology appropriate to the culture and the environment in which it is placed.

Schumacher's popular book helped unify the efforts of those concerned about environmental quality, of resource depletion, and civil rights/human rights. The successes of the appropriate technology movement are documented in many publications and summarized in McRobie's Small is Possible. The agencies, organizations and groups involved in researching, producing, and promoting appropriate technology in the 1980s number over a hundred. That intermediate technology can be developed is clearly not a problem. But the illusion that the development of intermediate technology is a panacea for the needs of Third World peoples is a problem, when it diverts attention away from the social, political, educational and economic causes of human suffering, which are well beyond a "technological fix." Furthermore, there are many case histories of "failures" created by the introduction of inappropriate technologies (small and large) into other cultures. "Cultural appropriateness" is exceedingly difficult to ascertain without a thorough understanding of the cultural group. The mechanisms and means whereby appropriate technology is introduced is also a complex issue; just as one technology cannot meet all needs, nor can one approach. But rather than focus on these shortcomings, which have been pointed out by others, I would like to address another concern, that of arrogant ethnocentrism, which views appropriate technology as something developed by "us" in the laboratories of the industrialized nations as a solution for "them." This attitude harms rather than aids, and even worse, overlooks the creative viable systems devised, developed and tested through time by those who are the target recipients of the "new" (and better?) western technology.

While Third World rural populations might indeed be homogeneous in their poverty and low status vis a vis the national societies of which they are a part, they are not culturally homogeneous -- the sociocultural, linguistic, historic, environmental, and geographic diversity of these peoples is tremendous, as thousands of anthropolitical ethnographies attest.

Quite frankly, it is this diversity of human cultural systems, on which I base a glimmer of optimism for the future of our planet. For many of the earth's nonwestern cultures, including many peasant and low technology subsistence groups, share the NAEE's concern for the preservation and conservation of the environment, and have a similar orientation towards future generations, noticably lacking in much of industrialized society. I do not wish to "ennoble the savage" with gross overgeneralizations, for environmentally unsound practices are also present in nonwestern traditions, but rather to call attention to the fact that we do not have, and appropriate technology will not provide us with, "all the answers." Even as Shumacher noted in his last speech (1977, cited in McRobie) it is the poor illiterate peasants that are the "survival artists," not us. I do not know if he realized the fortuitousness of his choice of noun "artists," but it is in many cases apt. It is they who are expert at living in their environments, and it is we who should be learning from them, not setting outselves up as their teacher/ saviors. We are learning wiser environmental behavior, but we do not have a monopoly on this wisdom. The fuel efficient lorena stove from India is one example which has been recognized; but many other technologies and techniques are being cast aside by developers in their haste to introduce change.

Tropical forests are a case in point. Deforestation is occurring at an ever increasing rate, due to governmental efforts to colonize this "frontier" as a means of resolving population pressure, rather than undergo land reform, as a means of increasing production, and because wood is so versatile and marketable. The fragility of tropical forest ecosystems has become well known among scientists and specialists but we do not yet know how to be good custodians of it. Attempts to convert these regions to industrialized agriculture have been failures. To this end the World Bank examines the balanced management/use of the tropical forests by "tribal" peoples and attests to the need to preserve not only the forests but also those who are their "ecologically sound" managers:

> Tribal knowledge encompasses the ecosystem in its entirety, including the interdependence of floral and faunal species, the specificities of micro-zones and their interfaces, seasonal and longer-term variations in plant and animal life, reproduction, growth movement, and productivity: ...Only as tribal people are they equipped with the necessary values, knowledge, and organization to manage successfully the resources of marginal ecosystems. The preservation of these groups, therefore, is a significant economic opportunity for the nation, not a luxury. (Goodland, emphasis in original).

Much of the emphasis of appropriate technology focuses on agriculture, and the need to increase agricultural production. Appropriate tools, composting techniques, irrigation pumps, etc., are all "successes" in this direction. It must be remembered, however, that many rural agriculturalists are landless; hence improvements which increase production might only exacerbate the gap between land owners and those who work the land -- as experience with the "green revolution" in cereal grain production made clear in some areas. Serious agrarian reform and redistribution of wealth is a necessity.

All the appropriate technology in the world will not help poor people if the resource bases they must rely upon are not guaranteed to them. For example, the ecologically balanced horticultural techniques of a tropical forest group is for naught if the entire area in which they reside is commissioned to a logging firm or open to widespread colonization by outsiders (rich or poor). Small, efficient irrigation pumps are useless if water upstream is diverted for use by an industrial plant or a large estate.

There is another unpleasant side to this issue. Poverty of some people may be seen as advantageous for some of the few who are not poor. Political resistance to agrarian reform enforcement of civil and human rights laws, etc., are in the hands of those who own and control the resources of a territory. This may result in covert or overt resistance to the introduction of anything which might increase the quality-of-life of peasants and other poor sectors of the population and which might raise their consciousnesses.

Viewed from the position of the governments of the Third World countries, they find themselves beset with a myriad of complex and competing demands on their abilities and resources. They must find ways to meet the needs of their burgeoning populations, to pay their foreign debts, to increase exports and, most of them feel strongly, to assert their independence and reduce their dependency on the First World. They must also instill national feeling and pride in their citizens, which includes the overcoming of psychological barriers regarding the supposed inferiority of national or local products when compared to imported goods.

Features of appropriate technology which have appeal to Third World governments include the creation of more jobs, increased agricultural production, the feasibility of import substitution, and the development of rural areas in order to stem the flow of massive outmigration to congested urban areas. Aesthetic and preservation arguments will have little impact on them. A number of governments have development plans on paper which have been implemented in varying degrees, but all too often, no matter how sophisticated the plans, implementation is problematic due to bureaucratic and infrastructural bottlenecks and roadblocks. At any rate, that proportion of national budgets committed to achieve development via appropriate technology is usually, like appropriate technology itself, "small." John Coleman's query concerning the appropriate technology movement designed for Third World development is apropos and reflects the apprehension of many Third World countries:

> Does the adoption of intermediate, small-scale technology by the less-developed nations entail their permanent relegation to second-class world citizens cut off from a material base for psychic and social mobility and growth? Can they be persuaded to lower expectations in the face of unabated affluence in the developed world, communicated to them through a worldwide media network? The first ethical basis for intermediate technology is that it be applied both to developed and less developed countries.

Will appropriate technology be used to forestall or deter national institutional reform? Or to maintain and preserve the status quo for the middle and upper classes of developed nations?

If so, it will, in my opinion, have failed in its endeavor.

In 1980, ten scholars (educators, policy makers, businessmen, administrators) -- two each from five South East Asian countries -- participated in a two month ethnographic futures research project at Stanford University, using a technique designed by R. Textor and described in A Handbook on Ethnographic Futures Research. The product of this endeavor was three scenarios (optimistic, pessimistic and most probable) for the year 2005. Since this was a future forecast produced not by western scientists but by scholars from the Third World, I believe it instructive to consider it. Two points were emphasized by the group: 1) whatever solution is achieved, it will be a South East Asian invention, not a direct transplant from the developed world, and 2) education is the key. The group formulated the following as realistic necessary goals for their world region, if it is "to attain and foster the total well being of every individual in the region:

1. National unity and political stability;
2. A stronger sense of appreciation of, and pride in, our national and regional cultural heritages;
3. More efficiency and honesty in our government bureaucracies;
4. Greater equity in access to, and distribution of, social and economic opportunities, thereby minimizing if not eradicating poverty, disease, and unemployment;
5. Maintaining population levels conductive to social and economic growth and increased agricultural and industrial production;
6. Development and conservation of renewable and nonrenewable resources;
7. Diversified exports and an expansion of the world market for these exports.

Appropriate technology can go a long way to help achieve some of these goals. Solutions from other cultures must be considered in addition to those produced by western technology. Political and social wisdom, peace and understanding, are necessary for the rest.

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4. Invited Paper

Perkins, John H. "Historical Perspectives on Culture and Technology: Insights from the History of Science and Technology." The Evergreen State College, Olympia, Washington 98505

Environmental education should be designed within a perspective that includes culture and technology. Perhaps the easiest way to accomplish this task is to adopt the concept that technology is a special form of human knowledge that allows us to make use of natural resources in the environment in order to satisfy our needs and desires for material goods.

In this scheme, technology is not just a "machine" of some sort. Technology is knowledge of many sorts: of resources to be gathered, of ways to *build* a machine or *develop* a process for getting at those resources, of ways in which to *use* the machine or process, and of ways in which to distribute the "proceeds" derived from the use of the technology. In short, technology is a complex social phenomenon that links people to their environmental resources and enables them to survive, sometimes with luxury.

Within the perspective of technology and culture, environmental education is far more than its stereotypical form of natural history, nature trails, and wilderness study. A perspective including culture and technology gives environmental education a method for helping students understand how societies use their resource base through technical knowledge that has deep roots in the history and practices of the society.

Neither the history of science nor the history of technology, both well developed fields of study, has given much attention toward answering the questions that would be of most use to environmental educators. Nevertheless, I will argue that the history of science and technology have developed sufficiently to suggest at least three major points that are of direct utility to environmental education.

First, many environmental disputes and most environmental education are closely linked to the notion that scientific evidence is central to understanding and to solving environmental problems. In other words, a field of study exists that we can call "environmental science." To be educated environmentally means in some sense to be knowledgeable about the scientific understanding of the environment. Moreover, this field of "environmental science" has grown rapidly over the past twenty years. Insights from the history of science can be used to understand the study of the changes and growth in environmental science.

Second, specific disputes about environmental resources often are tangled with confusion between the so-called "technical" aspects of the problem and the supposedly separate "social" or "political" parts of the problem. Studies in the history of technology offer valuable insights into how to understand technology as a social phenomenon. I would argue, in fact, that it is a false dichotomy to separate the technical and sociopolitical parts of an environmental problem for other than analytical purposes at the beginning of studying a particular problem. Rather, technology must be seen as knowledge that develops through social processes and is used within sociopolitical institutions. Another way of putting this is to say that technology is never out of control; people using technology frequently are, and the process of environmental problem solving is to re-establish a consensus about the proper limits of human freedom to use technical knowledge.

Third and finally, environmental educators should instill within their students the notion that environmental problem solving usually takes a long time. Historical perspective is essential to a professional in the environmental field. It helps develop patience, tenacity, and balance in the problem solving in which our students will engage.

I'd like to illustrate these points by showing how each of them adds richness of understanding to one of the most important events in environmental resource management during the past two decades: the decision by the U.S. EPA to ban most uses of the insecticide, DDT. In 1971, EPA Administrator William Ruckleshaus issued the decision to de-register the chemical for most uses, to be effective on June 30, 1972. This decision followed approximately five years of arduous, frequently tumultuous, often emotional debate in the press, the scientific journals, the streets, the State and Federal courts, scientific advisory committees, and the chambers of an administrative law judge.

Politically and scientifically, Ruckleshaus had to gamble no matter what his decision was. He ultimately couched his argument in the evidence of science that DDT posed risks to humans and other species and that, given the benefits from using the chemical, these risks were unacceptable to American society. At face value, his decision looked like a straightforward effort to use the limited scientific knowledge available and make the best judgment he could. Only a broader historical framework can show why the EPA decision was so thorny on both scientific and political grounds.

First, Ruckleshaus' decision came very soon (within ten years) of a rather momentous set of upsets in the nature of "environmental science." Rachel Carson published her classic work, Silent Spring, in 1962. This book, through the power of Carson's methodology and philosophy, forced changes in the definition of environmental science.

Prior to 1962, the field of environmental science was really a set of scattered professions known variously as agronomy, soil science, forestry, entomology, sanitary engineering, fish and wildlife management, recreational management, and several other engineering disciplines. What seems to have characterized these disciplines is that they were particularized on specific technical problems and lacked any self-consciousness about jointly being a unified field of study. Agronomists served the interests of farmers, and wildlife managers did their work for the hunting lobby. Little if any communication occurred between the different fields, and no one felt that all of them together were managing a global ecosystem. In addition, the philosophical basis on which each of these traditional environmental sciences rested was one of utilitarianism and exploitation. With few exceptions, conservation measures were seen as important only because they increased the long-term utility of resources.

Carson's book forced a change in the meaning of environmental science. She had a global perspective on the meaning of ecosystems. In her view it was incredible that entomologists, one of the traditional disciplines in environmental science, would even dream of using chemicals that had such a pervasive influence so far beyond the confines of where they were applied as insecticides. That these entomologists would object even to the raising of questions about the ultimate effects of their insecticidal technologies was completely unacceptable to Carson on scientific grounds.

Beyond technical questions, Silent Spring introduced a foreign metaphysical concept to the traditional environmental sciences: the sacredness of life and of natural ecosystems that was intrinsic to them and had no derivation from any utility of their resources. Carson was a pantheist within a peer group of other scientists who relegated material life to mere dead, atomistic matter devoid of any spiritual properties.

The combination of both scientific and philosophical challenge to traditional environmental science was overwhelming in its impact. It made her attack on a specific set of technological practices unforgetable and unavoidable.

Carson's book was by no means the only event to rock the foundations of environmental science during the 1960s, but if one looks at the scientific arguments being put forth about DDT at the end of the 1960s compared to the beginning of the decade, one has to realize that extraordinary changes had occurred in this field of study. By 1970, allegations were being made: that DDT may cause cancer in humans; that certain species of raptorial birds were being decimated because DDT interfered with calcium metabolism and caused thin egg shells to be formed; that DDT was so persistant and so mobile in the environment that the entire globe was contaminated with it, even species, air, and water thousands of kilometers from where the material had originally been applied.

Scientifically, these allegations that reached Ruckleshaus were new and verification by replication was largely undone. Moreover, epidemeological studies on cancer and other effects of the chemical were incomplete, grossly imperfect, and of considerable uncertainty. The philosophical stance about the environment implicit in Silent Spring was foreign and alien to most traditional environmental scientists. The established professionals had hardly had time to hear and understand the new philosophy let alone decide whether they could or would accept it. In short, a historical perspective on the changes in environmental science during the 1960s suggests that Ruckeshaus really made a rather radical decision on DDT, hardly a straightforward one.

The second utility of historical perspective on the DDT decision comes from questions about how DDT was an integral part of the farming technologies in use at the time it was banned. Most of the crusaders against DDT had no sophisticated understanding of how DDT and other insecticides were an integral part of agriculture's social and political structure. Opponents of the chemical focused on its environmental hazards and argued that the dangers simply made continued use unthinkable. To the extent that opponents of DDT gave serious consideration to how farmers and other users were to operate without the chemical, they tended to focus on technical weaknesses of DDT and the promise of new methods of insect control known as Integrated Pest Management (IPM). Users of the chemical justifiably felt that their needs were being given insufficient attention by proponents of the ban.

Those arguing for a ban had both an intellectual and social obligation to understand more about the effects of the ban on users. Much of the emotionalism of the DDT debate lay in the inability of urban-reared environmentalists to comprehend the fundamental role of chemicals in today's farm technology. Had proponents of the ban been better educated about the problems faced by users of insecticidal technologies, they probably could have plotted better political strategy and they could have short-circuited much of the pointless wrangling that characterized the DDT debate. Environmental educators have an obligation to give their students a framework in which they can understand the conjunction of technical and social factors in the use of particular technologies. Students must learn that banning a machine is tantamount to banning or severely altering the sociopolitical institutions that use that technology.

Finally, history of science and technology can help students in environmental fields gain a better perspective on how long it takes to solve an environmental problem. The five years of intensive debate on DDT (1967-1972) was in one sense a very short period of time. Yet some people in the anti-DDT crusade felt the delays were intolerable. Some gave up and dropped out. Partisans, particularly young ones, are always impatient. Impatience is frequently desirable in problem solvers, but not if it comes at the expense of tenacity, stability, rationality, and faith in ultimate success. Environmental educators should use the perspective of history to temper and make more effective the natural impatience of students. It will help them become better problem solvers.

Summary: Recommendations for Teaching

1. Develop the concept that environmental science is complex intellectually, philosophically, and socially. In addition it is still undergoing extraordinary changes.
2. Develop the concept that technology is a social phenomenon and that most environmental disputes can be analyzed as arguments over a particular set of technical practices. Understanding an environmental problem means one has to understand the technology under fire and its role in a complex society.
3. Develop the perspective of environmental problem solving as a long-term struggle. Important environmental problems are not solved overnight; if they are, then either the problem was not very important after all or the solution was not a good one.

Suggestions for Further Reading

Carson, Rachel. 1962. Silent Spring. Boston, Houghton Mifflin Co., 368 pp.

Dunlap, Thomas B. 1981. DDT. Princeton, Princeton University Press, 318 pp.

Graham, Frank, Jr. 1970. Since Silent Spring. Greenwich, Connecticut, Fawcett Publications, Inc., 288 pp.

Perkins, John H. 1982. Insects, Experts, and the Insecticide Crisis. New York, Plenum Press, 304 pp.

Whorton, James C. 1974. Before Silent Spring. Princeton, Princeton University Press, 288 pp.

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5. Invited Paper

Petulla, Joseph A. "Technology and the Homogenization of Cultures"
History Department, University of San Francisco, San Francisco, California

Anthropologist Lauriston Sharp provided a generation of scholars with provocative research questions in his "Steel Axes for Stone Age Australians," a monograph based on Australian research in 1933-35. The study shows how the introduction of technology of steel axes caused a profound upheaval of all aspects -- economic, religious and social -- of the Yir Yorant aboriginal group in Australia. A stone age axe culture supporting a wide network of trading partners, aboriginal mythologies and a male dominant hierarchy was replaced by missionary Christianity dispensing steel axes that at once offered labor-saving opportunities, western religious practices and social liberation of women (when they received axes from missionaries) as well as all their enslavement to prostitution (so that their husbands could obtain the steel axes from other white men).

The comments below address another effect of technological diffusion among cultures of the world, whether or not the technology is socially disruptive, i.e. the globalization of markets and the homogenization of cultures through modern media and transport. At present, people in the most remote areas know about labor-saving devices and are drawn to other allurements of modern life. Cassettes, radio, TV, tourists and other modes of communication are bombarding most withdrawn geographic locations with messages promising a better or more exciting life. Theodore Levitt (Harvard Business Review, May/June 1983) claims that markets have been so globalized because of modern communication technologies that consumer preferences no longer exist on a merely regional or national scale: "Worldwide communications carry everywhere the constant drumbeat of modern possibilities to lighten and enhance work, raise living standards, divert and entertain."

The pattern of "globalization" continues a process of technological and economic integration that started over a century ago with national advertising in journals and newspapers and the possibility of delivering goods over long distances by means of a mushrooming railroad network. Radio and television advertising along with advanced transportation technologies during this century assured the corporations of the "globalization of markets," the title of Levitt's article.

The images of such globalization are the sound of rock music from cassettes and even TV's in corrugated huts of South American favelas and Mongolian villages, silk shirts and French cut trousers in the Middle East, pirated movies and records in the Australian and African bush, MacDonalds hamburgers, coke bottles and Levi jeans everywhere. These goods may or may not produce the social upheaval of steel axes in Australia, but they are representative of the homogenization of cultures because of technological and economic integration. As Daniel Boorstin put it, we are living in "the Republic of Technology (whose) supreme law...is convergence, the tendency for everything to become like everything else." From the standardization of products comes the homogenization of needs and desires. A few weeks ago in the Travel section of the Sunday New York Times was a picture of an Asian peasant in primitive dress bending over his cheap battery-operated radio and cassette player.

Questions perennially raised by the process are: Does technology cause the expectation of a better life or do people themselves recognize in technology the key to a better life? Is it possible to stop the trend, if such is desirable, or what can be done to at least slow it down? Religions from Ancient Judaism, medieval Christianity to modern Mohammedism (at least in Iran) have tried to stop the technologies of modern cultures from disrupting their social and religious practices. Usually to little avail, sometimes because the technology is labor-saving and sometimes because it is inherently exciting or interesting to humans. Oberlin College students were shocked to find many people playing cassettes of disco music and John Denver in the most remote region of China, an isolated area surrounded by mountains. This happened during the apex of the Cultural Revolution.

So is the homogenization of cultures inevitable? I don't think so as long as people begin to understand the problem, what might be lost in the process of economic integration, and consciously develop institutions to protect the essentials of indigenous cultures. This of course is what already is happening many places around the world. Technology is not all-powerful, in fact it inevitably becomes obsolete. Consciousness can endure indefinitely.

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6. Invited Paper

Shrader-Frechette, Kristin "Technology and Philosophy: Which Controls Which?" Professor of Environmental Studies and the Philosophy of Science, University of California, Santa Barbara, California 93106.

Some Philosophical Questions Raised By Technology

1. Is a technology innocent until proven guilty of environmental harm or guilty until proved innocent?
2. Are there ever adequate ethical grounds for using a technology which causes irreversible environmental effects?

3. Should science policy be controlled by scientists or by the public, especially those likely to be affected by it?
4. Do citizens have an absolute right to equal protection from environmental (e.g., carcinogenic, mutagenic, teratogenic) hazards to which they have not given their consent?
5. If citizens are exposed to environmental hazards against their will, do they have due process rights to compensation from the offender?

Some Goals For Environmental Educators

1. We need to examine the ethical presuppositions and consequences of numerous environmental and technological issues. We need to ask questions about equity, consent, due process and rights to future generations.
2. We need to teach our students how to logically analyze the arguments on both sides of environmental and technological controversies otherwise, they will be the victims of the best hustlers doing the fastest talking.
3. We need to stop teaching our students "Cookbook Science" and to make them aware of how alternative methodological assumptions can generate contradictory scientific conclusions. We have to enable them to love and to understand science, so that they can tell, in an instant, when it is done poorly or used in the service of special interests.
4. We need to teach students to pursue alternative explanations and to study both sides of controversial issues, rather than to teach them to rationalize either their environmentalist or industrialist prejudices.
5. We need to make students aware of the vast resources available through the government documents sections of their libraries. All significant environmental and technological proposals have been carefully examined through environmental impact assessments and technology assessments funded under U.S. government contract.
6. We need to divest students of their political and historical naivete so they are not surprised to discover, for example, that the AEC promoted the industry it was supposed to be regulating, and that the Department of Agriculture promotes the policies of the petrochemical industry.
7. We need to encourage our students never to pursue environmentalism as if it were opposed to science, or to progress, or to what is best in the American way. Authentic science, done critically, authentic Americanism demands environmentalism.

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7. Invited Paper

Skolimowski, Henry R. "Culture, Intrinsic Values, and Environmental Education." Professor of Engineering, Department of Humanities, University of Michigan, Ann Arbor, Michigan 48109

> Education is not as sudden as a massacre but more deadly in the long run. (Mark Twain)

And so it is. By furnishing the mind with right perspectives, we prepare it for the variety of right interactions with other forms of life; or by stuffing it with disconnected bits of unrelated information, we anesthetize it, and not infrequently poison it, so that it goes on raping environments, and harming itself in the process. In our times environmental education -- in the broad sense of the term -- is of crucial importance as it spells out our relationships with all living forms. Environmental education starts from the cradle. It is continued with instilling good table manners which is but a camouflaged and attenuated form of reverence for the environment, of what we eat, with whom we interact and how.

We become inculcated with right attitudes to nature, and ultimately to the cosmos not through the process of counting economic benefits, but through the process of instilling right values which are the fountain springs of all thought and action. For it is undeniably the case that values justify our thinking; our explicit thinking in its turn is a justification of our action.

Thus values can be seen as the nervous system of our culture. The futility of so many of our efforts to improve our present world, and specifically the existing systems of education, stems from the fact that we address ourselves to symptoms and not to causes. It is as if we are trying to improve the dexterity of our fingers by working on them while what is at stake is the damage of the nervous system which makes those fingers unable to work. Often indeed, we are ridiculous enough to manicure our finger nails thinking that this will be a remedy for our damaged nervous system.

Environmental education, and all education for that matter, is afflicted by the syndrome of superficiality because we, as educators, have been unable to address ourselves in depth to the central nervous system of our thinking: intrinsic values. There is considerable confusion about what environmental values really are because we have not made clear in our minds what values we are going to stand by, that is what values we are going to admit as our foundation. In the absence of a firm foundation of intrinsic values, instrumental values flourish. The highly sophisticated apparatus of logic, semantics, decision making theory, calculus of probability, Technology Assessment, and you just name it, are all used to justify and support cost/benefit analysis as the ultimate mode of validation.

No truly rational person would ever dare to argue that means should be used for the justification of our ends. Yet this is exactly what has happened with cost/benefit analysis method which reduces all that is uniquely human to economic and pecuniary terms. Curiously enough, on a deeper level of analysis we shall find that this clearly irrational situation is rationally justified; but in an indirect, subtle and devious way.

Our rationality has become our ultimate value, in a sense the chief intrinsic value. Let me be more precise, scientific rationality or better still technological/economic rationality has become the codifier of our thinking and the arbiter of our methodologies. This codifier forces us to accept instrumental values, and specifically cost/benefit analysis as a legitimate and sufficient mode of analysis.

There is a huge methodological confusion here, or we could even say a methodological subterfuge: scientific rationality is not supposed to be an arbiter of values; it is supposed to be indifferent to the value process -- a clear, clinical and methodical mode of analysis of known facts. But this is not how it works in practice. Scientific rationality does not stand aloof and apart from values; on the contrary, it forces all the discourse and all the analyses into its distinctive terms: quantitative, physical, instrumental, pecuniary. The final outcome is that scientific rationality works like a filter -- it excludes value considerations which are outside its universe of discourse. Scientific rationality is thus a pernicious value filter; pernicious because it claims to be indifferent while in fact it assumes the role of the supreme value, and eliminates in the process other intrinsic values.

This is clearly an irrational situation; in spite of its seeming rationality. But you cannot argue rationally with the present myopic rationality for it will beat you to submission by trying to absorb you into its fold. This has happened over and again. We are in a sense sad victims of our limited reason; and limited it is indeed.

Instead we must start our discourse where it belongs -- with a reassertion of right values, that intrinsic values. Rachel Carson made her case in Silent Spring not because she mastered sufficient numbers of scientific facts and presented a clear cut empirical evidence. The empirical evidence was available to everybody. But others could not see it. For the point is that empirical evidence is a function of our frameworks, of our theories. There are no empirical facts outside, or independently of our theories.

What Carson saw was a violation of a principle which she considered most important: the sanctity of life. She made her case because she asserted an important value -- the sacredness of life, and stood firm by this value; against the slings and arrows of insensed critics many of whom could not even see what she was asserting.

At the foundation of all environmental values, and indeed of a meaningful environmental education must be a clear perception of the uniqueness of life, of the unique value of life, or to use Rachel Carson's term of "the sacredness of life." This must be our anchorage. A right understanding of the heritage of life leads us straight to the assertion of reverence for life as one of the chief environmental values.

Education derives from the Latin term "educare," which means to lead. In order to lead we have to see. Seeing as enlightment means reverence. Our mind must not only be a thinking mind; it must also be a reverential mind. (Thinking alone can be monstrous; witness the application of scientific rationality to the creation of the gases that were used in the Nazis extermination camps). The story of Oedipus Rex can be read on various levels. On one level it is a story about seeing, and not seeing. The resourceful, ingenious and brilliant Oedipus cannot see, except on the surface. The blind priest Teiresias has no eyes to see and yet he sees beyond the surface. Thus the blind is seeing while the seeing is blind.

The anology with scientific rationality is quite close. Scientific rationality cannot see beyond the surface; to that extent it is often blind. While our intrinsic values (with the help of our insights and intuition) though they do not have the dexterity of logic and the mastery of facts at their disposal, can see nevertheless. That is the way Rachel Carson saw.

Let us be quite clear that what we are proposing is not (emphatically not) an anti-science attitude, but an analysis of a new mode of rationality based on intrinsic values. Too often we have been smothered by the bogus cry "this is anti-science," and prevented from a deeper analysis, and thus from seeing, in the name of superficial seeing, thus blindness.

Education is about the ends of human life; otherwise it is a vocational training. Education based on reverence for life spells out the principle of universal equity (or distributive justice) not only for other members of the human family but for all sentient beings. Unless we make the principle of universal equity a part of our core, a part of our central nervous system of values, our environmental values will be sooner or later subverted by instrumental values with the inevitable triumph of cost/benefit analysis.

Another intrinsic value which we must entertain and accept is that of RESPONSIBILITY, which is a unique attribute of being human. Our humanity in us is in proportion to responsibility we assume and live by. Narrow specialization and a triumph of the expert is an abdication of our responsibility. By the same token it is an abrogation of our own humanity. Idiots, criminals, and small infants cannot assume and peruse their responsibility; to that degree they are excluded from the human family. So many experts and specialists are idiots in the root (Greek) sense of the word as they refuse to partake in public affairs and do not accept any universal responsibility. In so far as we are all becoming experts, this syndrome of idiocy is stigmatizing us all.

The three intrinsic values I have briefly discussed: reverence for life, universal equity and responsibility are, in my opinion, at the core of environmental education worthy of its name. Unless some core of intrinsic values is accepted and rigorously applied, environmental education is a sham.

Nor should we presume that any implementation of intrinsic values will be easy. It never was: either in Moses' time or in Solomon's time; and never will. But we should not fool ourselves that computers will do it for us or the superficial cost/benefit analysis method. Moral choices and moral decisions have been among the most difficult in the human universe; there are not any easier to make in our complex technological world.

Culture is about those irreducible symbolic interactions which make our lives deeper, more varied, more enhancing and uniquely human. To reduce the variety of intrinsic values of a culture to one is to annihilate the richness of the culture; it is simultaneously to strip us off of a part of our acquired humanity. Whoever is rational and responsible will fight against this encroachment on our human rights and on our evolutionary rights. At this point in history we also have to look after our evolutionary heritage. The maintenance of intrinsic values is a part of our evolutionary responsibility.

The direction in which education set a man will determine his future life. (Plato)

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8. Invited Paper

Yambert, Paul A. "Technological Futures: A Question of Ecological and Cultural Appropriateness" Department of Forestry, Southern Illinois University at Carbondale, Carbondale, Illinois 62902.

Introductory Comments

The term "appropriate technology" is subject to considerable misunderstanding. By scrutinizing the criteria and concepts currently implicit in each of the words comprising the term, we will attempt to:

1. gain better understanding of the term;
2. develop revised criteria applicable to the appropriate technology of the future.

- Criteria for Appropriateness
    - Current Criteria
        - Scale
        - Complexity
        - Materials source(s)
        - Productivity/Efficiency
        - Economics
        - Environmental impact(s)
    - Proposed Criteria
        - Communicable
        - Cybernetic
        - Synergistic
- Criteria for Technology
    - Current Criteria
        - Traditional (inertial)
        - Anarchical (eclectic)
    - Proposed Criteria
        - Tractable (bionic/econic)
        - Tractable (socionic)

Questions

1. If resource sufficiency depends upon cooperation and cooperation depends (to some extent) upon moral principles; do we have our environmental education priorities straight? (Tawney, 1920).
2. If we seek societal change more drastic than reform and less drastic than revolution, what should we do and can we do it in time? (Tawney, 1920).
3. If all disciplines have their own set of tacitly assumed axioms, is an agonizing reappraisal essential both for our intellectual honesty -- and for our survival? e.g. most of us have rejected the economists' concept of the unseen hand of the marketplace (economic harmonics) but still cling steadfastly to the concept of the unseen hand of nature

(ecological harmonics) i.e., the so-called balance of nature.

4. If we take seriously Tawney's contention that all rights are "conditional and derivative," should we extend this concept and assert that the right of all living (and non-living) things should be directly proportional to their contribution toward the homeostasis of the ecosystem? (Tawney, 1920).
5. If decades of technological breakthroughs have preceded our current crises of resource degradation and depletion, on what should the Cornucopians among us base their hopes for the future? (Webb, 1982).
6. If we are disciples of Leopold believing that "good" may be defined as "that which preserves the beauty, integrity or stability of the ecosystem;"is it appropriate for us to ask whether these three goals are consonant and compatible?
7. If, as our ecological primers state, everything is connected to everything else, then nothing is external to the ecosystem. If nothing is external to the ecosystem, then the concept of external costs is a perilous myth. How can our educational system (broadly defined) best expunge this sort of mythinformation?
8. If ecosystems are adapted to much more modest levels of stress than man is capable of inflicting; then how can we best proceed to effect a timely reversal to our traditional, and now pervasive "conquest of nature"?
9. If internalizing all costs of production would generally (but not uniformly) raise prices and reduce environmentally induced diseases, then can we conclude that the net benefits would exceed the net costs for the poor among us?
10. If we are striving to define, develop and disseminate technologies which are both sociologically and ecologically appropriate; then have we any compelling evidence that these two related goals are totally and ineluctably compatible?

Issues

If by "issue" we mean a final outcome which constitutes a solution, few will be found in this presentation. However, if by "issue" we mean a point which is in dispute and, perhaps, ready for a decision; then we can find so many issues that, in this presentation, they cannot be addressed adequately. Consequently a few issues, in the latter sense, have been selected for their significance and their relevance to the questions which follow.

1. Growth

The point has been made that unqualified arguments either for or against "growth" are naive. As a minimal attempt toward resolving this issue, we should carefully and consistently distinguish between undifferentiated growth and organic growth. The former is the type of growth which, like world population growth, clearly must come to an end. Indeed there is nearly overwhelming evidence that some forms of undifferentiated growth, including human population, have already proceded too far to be sustained. The latter, i.e., organic growth, involves both a tested blueprint or plan and a proviso that the growth of parts is to be determined by their role in promoting the welfare of the ecosystem (Mesarovic, et. al., 1976).

2. Equity

The issue of equity really is three issues; interspatial, intertemporal and intercongeneral equity. Analysis of the current world situation leads toward the conclusion that the gap between the rich and poor is increasing, that the rights of future generations are routinely discounted at high rates, and that our recognition of the rights of other functioning components of the ecosystem is both tentative and tardy.

3. Perspectives

The neo-Malthusian/Cornucopian controversy remains with us under different guises and in many facets of our lives. What is said here is most unlikely to change anyone's perspective, so only a few points, especially relevant to the balance of our discussion will be made.

> "The way to insure that doomsday prophesies will be self-fulfilling is to ignore them..." (Mesarovic, et. al., 1976).

If the neo-Malthusians are wrong, our lives may turn out to have been somewhat more frugal than necessary; if the Cornucopians are wrong, our lives may turn out to have been the last and the least ethical of human lives.

In this context, it seems clear that the arguments for prudence outweigh the arguments for faith.

4. Dissemination

The mechanisms for introducing (new) technologies to other people in other nations all tend to promote one-way flow from the over-developed to the less-developed countries (Norman, 1978). This state of affairs systematically severely limits our collective opportunities to locate and promote technologies which are already appropriate or to find components of such technologies which can be incorporated in building the technological diversity which is prerequisite to our achieving a complementary set of technologies which are socially and technologically sustainable.

5. Consistency

We are all aware of the glaring inconsistencies and logic-tight compartments which characterize the muddled thinking of other people. Yet, in our own individual and collective lifestyles, we persist in actions which are not only inconsistent, but also counterproductive. The issues here seems to evade resolution, in part because there are at least three serious vacuums which impinge upon it. One is a vacuum in moral and political leadership. Another is in that type of comprehensive knowledge which allows us to know which technologies are, indeed, socially and technologically viable. The third vacuum seems to be in our own moral commitment to do what is right (or refrain from doing what is wrong) even when we know (Peccei, 1981).

6. Sequence of Strategies

Culturally, the over-developed nations in general and the United States in particular have subscribed to a "shoot from the hip" philosophy. That is, we tend to attack the environmental problems with a powerful array of technologies without first ascertaining which, if any of these technologies is required.

As a mundane, but illustrative example, we find some insects in our garden and promptly acquire a spray can of pesticide to halt the presumed menace. Ideas such as: there may be no problem, the problem may be alleviated by the use of bottomless paper cups as collars for the plants, or natural tithing is not so bad are literally and figuratively lost in the fog.

Resolution of this issue seems to await our finding and accepting a systematic method for making a selection from our arsenal of technologies. For starters we might experiment with and evaluate the following sequence:

a. genetic selection
b. biological control
c. cultural treatment
d. chemical control via:
    phenomones
    poisons
e. radiation

7. Ecumencial Ecology

In blunt terms, nationalism, parochialism, jingoism etc., can, and frequently do, serve as impediments to developing and implementing appropriate technologies.

Our analysis of appropriateness with reference to scale leads us inevitably to the conclusion that some of our problems can be effectively solved only at the international level. The androgyny of an aging population may mitigate this problem exemplified by our nationalistic oratory and nuclear sabor rattling, but androgyny alone will clearly be too little; too late.

When we in the United States cease to speak of the problems of Peru or the problems of Pakistan, and speak instead of our problems, then and only then, will there be a ray of hope.

The clarion call of the future must be on ecological extension of "Ich bin ein Berliner" perhaps we shall all hear and respond to "Ich bin ein Weltburger."

Conclusion

At this point, and by consensus, it is customary to cast aside any perplexing issues which may have been raised and speak euphorically of the future. In good conscience, it is not possible for me to do this for you or to you. My attempts to develop expertise in environmental eschatology have led me inextricably into the camp of the pessimists. I am close to despair not only because of the thorny nature of the issues and questions which have been raised concerning the pursuit of appropriate technology, but also (and more fundamentally) because I see so little evidence that *Homo sapiens* have evolved with the appropriate "software" for overcoming these challenges.

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9. Invited Paper

Richardson, William L. "Transport and Fate of Toxicants in the Great Lakes." Acting Chief, EPA Large Lakes Research Station, Grosse Isle, Michigan

The Great Lakes comprise 80% of the surface freshwater in North America and provides 45 million persons living in the basin with almost unlimited drinking and industrial process water. Five thousand miles of shoreline provide access for much of the multi-billion dollar tourist and recreational activity. Lucrative sport and commercial fisheries rely on these waters as do the transport of tremendous quantities of raw and refined commercial products and the disposal of industrial and municipal residues.

This resource represents a complex system of competing water uses as well as a delicate, interacting ecosystem. Such a situation requires a balance between the economic well being of the region with that of the ecosystem including human health. To arrive at rational decisions(i.e., to answer the basic question, "How much of a particular substance can be discharged to the environment yet meet the established quality standards?"), a quantitative understanding of the interacting and competing components of the system is required. Models relating cause and effect must be available to answer complex questions so that optimal decisions canbe made.

Research conducted over the past twelve years at and sponsored by the U.S. EPA, ERL-Duluth, Large Lakes Research Station at Grosse

Isle, has, in large part, been directed toward this end. Primarily, the modeling research has been conducted to synthesize surveillance and experimental data and to develop predictive capabilities of the transport and fate of pollutants, ranging from chloride to nutrients and their impact on the productivity of the lakes, to PCB's and their bioaccumulation in Great Lakes fish.

Although these models consist of very complicated computer programs and require an infrastructure of research funding, computers, and trained professionals to develop and maintain, the results of the modeling research can, and has been, presented in terms the layman can understand. The environmental education may well review these models and elucidate the simple but profound relationships between cause and effect. Perhaps, simple- hypothetical interactive computer programs could be written for students to obtain insight into interacting systems where several forces result in not so obvious consequences. This presentation is an attempt to communicate some possibilities toward this end to the educational community.

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10. Invited Paper

Preston, John M. and Robert L. Ferrett. "Computerized Control of Energy in Interior Environments." Program Coordinator, Energy Management Degree Program, Eastern Michigan University, Ypsilanti, Michigan 48197; President En Tech, Inc., Ann Arbor, Michigan 48109

The building of power plants and burning of fossil fuels have become major issues throughout the country. The staggering cost increases of the past fifteen years, along with environmental concern about such issues as acid rain, thermal pollution, the disposal of radioactive waste, etc., have caused some to reassess the need for many of the power plants on the drawing board. The short-and long-term solution to the problems mentioned above seems to rest with a source of energy that will produce no radioactive waste, little pollution, and no increase in petroleum consumption. This source is, of course, energy efficiency, or, to use the time-worn phrase, conservation.

The word 'conservation' illicits visions of huddled masses shivering in dimly-lit offices and homes. To many it is a term synonymous with 'sacrifice.' and is viewed as an unacceptable solution to our energy shortages. Our contention is that a substantial portion of our energy consumption can be eliminated, with little noticeable change of either our working or living environment.

Recent estimates of potential conservation savings in the United States from a concerted national effort suggest that a 30%-40% energy reduction is possible. A reduction of energy consumption of this magnitude would greatly delay the need for additional electrical generating capacity for many years and reduce the environmental impact of burning fuel for heat.

Several electric utilities are recognizing the economic advantages of conservation. Many utilities, facing astronomical costs for new generating facilities, feel that it is simpler and cheaper to pay customers to reduce demand. Among the utilities around the country that have reached this conclusion are:

> Southern California Edison pays rebates on the basis of reduction in kilowatt hours of up to $50,000 per account. One supermarket chain should receive $150,000 for upgrading its refrigeration controls.
>
> Pacific Gas & Electric (North/Central California) will pay up to $100,000 to commercial/industrial companies retrofitting for energy efficiency. (PG&E has set aside $19 million for this program.)
>
> All major Texas utilities give rebates on purchases of new high SEER air conditioners, from $50-$140 per ton.

Florida, Kansas, Arizona, Minnesota, Nebraska, New Jersey, and Oklahoma are other states which have rebate programs.

Many people are well informed as to the methods for reducing energy consumption in residential buildings but are generally unaware of the problems and procedures which are appropriate for commercial and industrial buildings. The following is an explanation of some of the current practices which lead to high energy consumption in commercial buildings, a brief description of electric utility rate structures for large users, and the appropriate use of both high and low technology to reduce that consumption.

Present Practices

Equipment Sizing -- When the heating and cooling equipment are first chosen for a building their capacity is based on the extreme conditions which could be expected in that area of the country, the characteristics of the building envelope and the expected internal heat gain from equipment and personnel inside the building. Several factors result in the equipment being of too large a capacity for the current building and its present use.

1. By design the systems have fan motors which rarely need to run continuously at full power to meet the building's needs.
2. It is possible that the contractor decided to err on the high side when choosing the equipment to avoid the possibility of undersizing and additionally, higher profits usually accompany the larger capacity systems.
3. In many older buildings there has been a concerted effort to improve the building envelope by adding extra insulation, loading dock doors, and better windows.
4. Today's offices contain more electrical devices than in the past such as computers which result in increased heat gain. This results in oversize heating systems but undersize cooling systems.

Simple Controls -- The control logic available in the past has resulted in building spaces being heated, cooled, and lit when it wasn't needed and without regard to outdoor conditions. They are inexpensive and reliable.

Simultaneous Heating and Cooling -- In an effort to provide good local control of temperature and humidity in large buildings, two systems are commonly used. They are the multizone and terminal reheat systems. They work in the following manner:

Multizone -- In a central mechanical room the return air is divided into two air streams which are heated and cooled respectively. The cooling can remove excess humidity. A duct from each zone of the building is attached to the two air plenums where a damper determines the mix of hot and cool air which goes to that zone. This damper is controlled by the sensor from that zone. Since air flow is required to prevent odor build-up it is quite possible on mild days for both the heating and cooling systems to be in operation to maintain the building at the same temperature it is outdoors.

Terminal Reheat -- The central system either heats or cools the return air to a fixed temperature (typically 12.7° C, 55° F). The air is then sent out to the various zones in the building where a heating coil is located in the duct. The coil is controlled by the local sensor to add enough heat to satisfy the zone requirements. This system gives good humidity control in the summer and good local control but can result in operation of the heating system during the summer.

Surplus Outside Air -- Unlike homes, commercial buildings are required to draw a minimum amount of outside air into the circulation system. This is accomplished by means of a duct from the outside which is connected to the return air duct. There is usually a damper installed which can control the amount of outside air. In some cases these ducts are left open when the building isn't occupied. In most cases the ducts leak 10% to 40% when closed. During occupied hours the amount of air brought in is often in excess of the new ventilation codes (ASHRAE 90-75).

Utility Rate Structures

Larger electrical power consumers are charged for the total energy consumed as well as the greatest thirty minute demand. In general, the electric utilities have more than enough capacity to meet the total energy requirements. It is the non-uniform use pattern which requires surplus capacity. To pay for this extra capacity a special demand meter is used to determine the peak demands of the facility. The charge based on this peak demand is roughly a third of most energy bills (this varies widely from utility to utility). Often there are 'ratchet' clauses which require the customer to pay an additional charge each month for the highest demand the previous twelve months. This means that a single high peak could result in additional charges for the next twelve months.

Potential For Technical Solutions

Electrical Consumption

Scheduling -- Even with complex schedules, computerized controls can turn electrical loads on and off when not in use.

Duty Cycling -- Oversized equipment can be computer controlled to run for less than full time, for example an oversized ventilation fan could be turned off for five minutes each half hour.
Demand Limiting -- To control the temporary high demands which can occur when equipment is allowed to cycle on and off in an uncoordinated fashion, a central control can monitor the demand and 'shed' loads to avoid temporary peaks. For example, in the Detroit area, turning off a single 1000 watt device for thirty minutes at just the right time can save over $40 for the year.

Heating Fuel

Ventilation Control -- Commercial buildings require outside air be brought in through the air handling system during occupied hours. Outdoor air dampers can be closed automatically when the building is closed even on holidays and unusual schedules. Dampers can be adjusted to meet new ventilation requirements and seals added to reduce leakage when closed.
Night Temperature Setback -- Building temperature can be reduced at night and on weekends automatically. This is significant in medium to small buildings which may be closed 100 hours per week out of a total of only 168.
Optimum Start -- Following a night temperature setback the system must begin warm-up prior to opening. The amount of time needed can be automatically determined based on outdoor temperature and past building performance.
Zone Optimization -- Where humidity requirements permit, a central control unit can alter the supply of hot/cold air so that the zone of greatest need is satisfied by 100% hot/cold air. This eliminates the need for simultaneous heating and cooling in that zone and reduces it for the others.

Conclusion

The applications listed above can be accomplished with 'off-the-shelf' equipment and can achieve a simple payback of less than three years. The implementation of these measures can result in reducing the environmental impact of wasted energy as well as satisfying the financial requirements for investment. The public, and specifically the managers and owners of commercial buildings, need to be aware of the potential of this technology and how to apply it. Eastern Michigan University has established a Bachelor of Science degree in Energy Management Technology in an effort to supply the need for management personnel with this training. Informing the public is an educational process which the National Association for Environmental Education can play an important part.

II. Contributed Papers.

Paper Number 1

Aldridge, Alexandra. "Women and Technology: Innovation and Social Change." Department of Interdisciplinary Technology, Eastern Michican University, Ypsilanti, Michigan 48197.

All of us in the developed world, women and men, live and work in societies dominated by technological innovation and applications, societies shaped by what has been called a technological ethos. Yet the technology-related professions remain largely male in numbers and value systems. One is tempted to revive C.P. Snow's theory of the two cultures and say that it applies as well to the 1980's as to the 1950's, but that two cultures also separate men and traditional masculine professions from women and the traditionally feminine.

Even at a time when the majority of U.S. women between the ages of 18 and 62 are in the workforce (and increasing numbers of these are professionals), women lag substantially behind in careers identified with technology: engineering, computer science, technical management, even non -technical executive level positions in manufacturing companies. They also lag behind in the kind of math and science education which would normally help prepare them for these careers.

There is little sign that the recent acceleration of women into the workforce includes their equally rapid advancement into fields like mechanical engineering or information systems management. Almost none of the statistical evidence regarding women's employment and education points to anything but modest, sometimes negligible, gains in the 1980's. Some examples: unemployment rates, even for math and science educated women, are typically two to three times higher than men's -- particularly at the doctoral level. (The exception is in computer science where practially everyone is employed but where women are rare.) Women scientists and technologists not only have more difficulty finding jobs than do men with similar education and experience, they also find it harder to advance.

Turning to education for technical work, it is not surprising to find the fewest women preparing for the most tradionally male positions: in computer science, in mechanical and electrical engineering and in physics. In the entire decade of the 1970's, of all the U.S. Bachelor's degrees awarded in physics, only 8 percent went to women The steadiest gains have been made in medicine and engineering. In 1969, women composed less than 1 percent of all first year engineering classes, but almost 14 percent by 1979. By 1982, over 20 percent of the freshmen at one of the countries largest and most prestigious engineering schools, the University of Michigan, were women. But this does not mean that all or most will receive the Bachelor's degree or go on to graduate work in the field. At the same university, in 1982, women accounted for 1/3 or less of the graduate enrollment in medicine and business, and a meager 9 percent in engineering.

Some science and technology fields seem more attractive than others. There are more women doing R & D in chemistry than in any of the other physical sciences. In fact, by 1982, 55 percent of all the R & D conducted by women was in chemistry (including chemical engineering). Certainly, job prospects for chemistry graduates are good, but they are even better in computer science where so few women are found. Should we assume that chemistry is more compelling than computer science because it is more dependent on formula than on creative math? Therefore, should we conclude at the outset that "math anxiety" or math deficiencies account for the lack of women in technological fields? The answer is probably "yes" and that subject will be examined later. But there is also reason to believe, as many scholars have argued, that technological society itself (and industrial society before it) are not congenial to the feminine mind and imagination.

Although engineering enrollments have slowly increased during the past few years, women still gravitate to the more human oriented specializations like civil and industrial engineering. Although medical school enrollments among women are beginning to rise, so are the number of books and articles by women criticizing the masculine approach to health care. Women have traditionally rejected technological societies to the point where it is fair to say that their fantasies about life and work in an ideal future are almost exclusively retrogressive, essentially antitechnological in character. This generalization includes nonfiction prose by futurists like Hazel Henderson and Barbara Marx Hubbard, and science fiction utopias by writers as well known and intellectually sophisticated as Doris Lessing, Marge Piercy, and Ursula LeGuin. It includes utopian fantasies of the 19th century, and more to the point, the scenarios of contemporaries. What we see universally in feminine utopias is hostility to an urban civilization grounded in scientific and technological forms of knowledge. In Marge Piercy's Women at the Edge of Time, emphathetic or intuitive knowledge is much preferred to the abstract and theoretical. She describes a sort of touchie-feelie culture, with lots of communally reared babies, neuter-seeming men and conversations with animals. (Actually, her fantasy future is a revisioning of the ancient matriarchial, or mother-goddess dominated early agricultural societies.)

Even LeGuin, with her more masculine sensibility, discards the traditional uses and interpretations of science. The hero of The Dispossessed, while belonging to the most abstract, math-bassed camp possible (he is a theoretical physicist working on something similar to a unified field theory), also demonstrates the importance of a balanced, integrative way of seeing and being. On the homeliest level, this involves nurturing relationships; on the abstract plane it involves the integration of linear and simultaneous apprehensions of time. He is principally interested in the philosophical implications of theoretical physics and his scientific vision culminates in a more human-centered world view and in the invention of a device for face to face communication among "all of the peoples of the 9 known worlds."

Like Frithjof Capra (The Tao of Physics) or David Bohm (Wholeness and the Implicate Order) he risks ostracism from his discipline-bound colleagues in choosing to probe the analogues between quantum theory and the evolution of consciousness. In the process, LeGuin's hero follows the feminist utopian tradition by rejecting the mechanist rhetoric, narrow specialist goals and enumerative and algorithmic emphases of the scientific culture.

Lately, another approach to technological humanism has emerged, one which attempts to romanticize technology by depicting it as an extension, or an objectification, or materialization of mind and body. The work of James Burke in the BBC television series "Connections," and Robert Pirsig's *Zen and the Art of Motorcycle Maintenance* exemplifies this kind of thinking; and Witold Rybcnski has just written a version in *Taming the Tiger* (forthcoming from the Viking Press, 1983). Rybczynski claims that "technology begins not with the tool, but with the human imagination. So while technology is certainly artificial, it is also eminently natural. Moreover, since technology is a *human* activity, it is a part of human culture and hence reflects the human preoccupations of its time." If "technologies are merely natural extensions of ourselves, why then do we distrust them?" He offers a great many answers to this question including our nostalgic predisposition toward "wonderful old devices" which were replaced by "heartless modern technology" presumably in the minds of the male readership to which his book is directed.

If put to women, the most simple and obvious answer to the same question would be that little girls are not usually socialized to the machine. Daddies take little boys to help repair machinery in their workshops and to tinker with automobiles, motorcycles, bicycles, and lawnmowers. A number of historians have made the point that the majority of women have always worked for a living -- from the first agricultural civilization up to the time of the Industrial Revolution. But *since* that Industrial Revolution few women have ever had anything to do with machinery in the manufacturing process (except on the lowest operational levels): i.e., nothing to do with the design, manufacture, installation, and repair of steam engines or drill presses. Except for "domestic technologies" or "clerical technologies," machines, during the last 150 years have not been closely associated with female role functions. In urban societies, machines have not, traditionally, been integrated into the lives of little or big girls on a daily basis. No wonder women disappear then from the landscapes of their fantasies. They simply have not acquired the habit of mind which would lead to scientific, technological conceptualizations about how the world works.

More importantly, girls and women are *discouraged* from acquiring the habits of mind which would open them to scientific, technological interpretations of the world around them. (Furthermore, this has been the case since the beginning of the scientific revolution in the 17th century.) Let's return then to the issue of "math anxiety" or "math deficiency," specifically among American teen age girls.

It is a well known fact that boys test better, statistically speaking, than girls in, for example, special visualization which is necessary to geometry and trigonometry. It is an equally well known fact that girls are superior in verbal areas. We can assume, therefore, that if women have the capacity for manipulation of abstract concepts in the first place (and their superiority in verbal skills demonstrates this capability), math deficiencies, like machine phobias, have been, to a great degree, socially reinforced. (Researchers at the University of Michigan have recently shown that even spacial visualization can be learned; girls may start out performing poorly in that area, but with practice over a period of time on computerized models, their performance will equal that of boys'.)

Some of the most convincing evidence for social reinforcement of math disabilities among American women has been gathered into a collection of articles edited in 1980 by Lynn Fox. In Women and the Mathematical Mistique she summarizes the situation as:

1. Boys and girls do not differ in achievement as measured by arithmetic tests in the early grades.
2. But by the 7th grade (age 12) stunning sex differences emerge.
3. The differences are most significant among gifted children where one would expect exceptions to the rule.

Fox documents the result of a yearly contest held for math precocious young people in the state of Maryland during the 1970's. The contestants were 7th, 8th, and 9th graders who scored above the 95th percentile on a numerical concepts test. These boys and girls were given Scholastic Aptitude Tests for Math and from 1972 through 1979 the results were analyzed, in part, for sex differences. One representative example: in 1972, 22 boys (about 10%) scored 660-790. The highest score for a girl was 600. Although 4 percent of the contestants were girls, 19 percent of the boys scored higher than the highest scoring girl. A female math genius appeared very occasionally during this 8 year period, but rarely. The fact was that if we look at the number of participants, boys always outscored girls.

How do we account for this? In the first place, 7th grade, where the break occurs, coincides with puberty when girls become self conscious about acting out societal expectations. Lynn Fox offers additional reasons. For one, when math courses become optional, by the 10th or 11th grade, boys unlike girls, persist in studying it. On the whole, girls by that time, and earlier, report lack of self-confidence about learning math. They also question its relevance for future career goals, suggesting that they are docilely willing to take up traditional female occupations. Fox concludes that the overall social message transmitted to girls is that math is a male domain, and that message comes from parents, teachers, counselors, and peers, often thoughtlessly in the form of support and protection. One study from Women and the Mathematical Mystique reports that "parents have lower educational expectations for daughters than for sons and thus reinforce sex-role stereotypes by greater acceptance of low math achievemnts for girls."

Math anxiety and gender differentiated brain research are the two most topical issues bearing on women's progress in technological society. A great deal has been written during the past three years about both, in a range of periodicals from Science (AAAS) to Time. Lynn Fox's study provides many of the experiential reasons for math deficiencies among women, but the most difficult and speculative questions are biological. I'll summarize them briefly here.

Recent research on sexual differentation of the central nervous system shows that there are minor but statisically significant differences in brain function between males and females. We know that men have a record of superior performance in musical composition, chess, and theoretical physics. These activities apparently require alternation of prolonged concentration between the sequential and integrating hemispheres of the brain. Women find it easier to alternate rapidly between the analytic and the holistic mode. One conclusion which can be drawn is that women's ability to reach the top ranks of theoretical physics may be remote, but the same theory would account for their marked superiority in any form of governing or management, including industrial management.

However, another consideration may affect women's future status in a technological society. If the preceeding discussion places the heaviest emphasis on math and math-based skills and proclivities, something must be said about the future of math itself, specifically in view of new technologies. Some futurists have long suggested that computers will make it unnecessary to be brilliant at solving integrals in order to become a successful scientist or technologist. James Martin, the British systems expert who has written 30 or so highly respected books on computers and telecommunications, has said about the future or math: "Education will not need to stress how to solve equations or integrals other than simple ones. Instead, it can concentrate on how to use mathematics -- how to formulate problems so that the machines can solve them -- which is the truly creative part of mathematics. The range of problems an individual can solve will then be immensely greater."

Martin is worth quoting at length because the implications of his remarks are so significant for women in technology. He continues,

> An understanding of the basic ideas of calculus can be given to a relatively young child. The child can play with curves on a color graphics screen. The meanings that can be attached to the slope of the curve or the area under it can be explained. The child can be shown the meaning of velocity and acceleration. It will not be necessary to differentiate or integrate. That is something which a machine does. The labor of solving equations and mysteries of integration can be removed. The student instead concentrates on the meaning of mathematics and how it can become an important way of thinking about the world.

Thus several related generalizations of significance to women can be made:

- Most math education is outdated, both on the grammar school level and in engineering schools.
- Curriculums are necessary which demonstrate how math can be applied to problem solving in lieu of the emphasis on pure math in a mind-set of isolation from the on-going world.
- In addition to stressing applications of mathematics, schools assume a broader view of technical and scientific education, of what a technical or scientific person needs to know.
- Competency in math is more important than genius in order for people to make major contributions in technology-based fields from engineering to medicine to the management of technological organizations.

At the same time that education undergoes changes, the nature of technology based professionals will continue to change dramatically. In medicine, professionals will rely on diagnostic technologies, monitoring equipment, cable TV diagnosis, and information storage and retrieval systems containing everything from global health information to individual case histories (both of which are useful to diagnosis and cure.) This would make medical education less concerned with detail and reliance on memory, and more concerned with principles and the ability to go on learning as the field advances.

In engineering design fields, computer aid graphics (CAD) is changing the shape of the professions. What is required in high tech industry is alacrity, integrative mental abilities, and the wherewithal to perform a variety of operational and executive functions rather than an acute limited excellence in solving equations. In industrial management what is actually needed in a period of transition to new technologies is an expert sense of how to motive and manage people, how to perform in a variety of human resource activites and maintain a good grasp of technical operations.

Many, even most discussions of women and technology, including this one, have focussed on women's technical, scientific, and mathematical deficiencies. I do not want to elude this point by emphasizing that the solving of math problems will become a less vital part of any technological occupation. Nor do I wish to reassure women that their superior performance in verbal areas and their intregrative abilities alone will compensate for math deficiencies. (Although I have been tempted to describe "word anxiety" among boys and men, particularly among engineering students and industrial managers!) We are not living in the automated future quite yet and we should remember that at present some 60 percent of the advanced science and technology courses at major universities (The University of Michigan or representative) require 4 years of high school math. That fact alone eliminates the majority of young women from further study and hence from technological careers. In my opinion, women and girls must begin to make up for math deficiencies. At the very least they must acquire technological literacy -- which includes everything from mastering computer applications in a particular field to learning the rhetoric of technological society, that is, learning the principles of systems, learning about how the technological world works. Science and technology are the angles of vision, the abstract media through which we interpret the contemporary world. Women can aspire to reshape the nature of that interpretation. But to avoid it will mean remaining the professional underclass of the 21st century.

Paper number 2

Andrews, Elaine. "Community Appearance - An Environmental Issue: Organizing Resources for Local Action." University of Wisconsin Extension, Madison, Wisconsin 53706

Introduction

Designs for aesthetically pleasing and environmentally responsive cityscapes have been initiated and completed in towns and cities across the country. In each locality, the process of community appearance change has involved business owners, area planners, neighborhood and local interest groups. Recent visitors to cities such as Boston, Philadelphia, Pittsburgh, or Portland have enjoyed the results of community attention to appearance. But, in spite of high public or private awareness of the need to attend to community appearance issues in some urban areas, citizens in many towns and cities lack the awareness, knowledge, skills, or motivation to initiate a revitalization project.

In response to this need, the University of Wisconsin Cooperative Extension currently is sponsoring a four-year community appearance project. The project was initiated by a professor of landscape architecture who is supported by an environmental adult educator from the Extension Environment Resources Center and community cable-access specialist for U.S. Cable of Viking. Other team members have been identified as necessary. Through involvement with the first two of four small Wisconsin cities, the project staff can document the educational activities necessary to initiate a community appearance project and to develop it from an idea into action. This paper will explore the choice of community appearance as an environmental education topic for adults, summarize appropriate educational techniques and describe the results of the first year of the study in Portage, Wisconsin.

For many of us, the "built" environment is the environment. As environmentalists and educators, we are acutely aware of the threat of the built environment to the maintenance of balance in the natural ecosystem. But what about the human niche? In the foreward to Community and Privacy (Chermayeff, 1963), Kenneth Rexroth summarizes the issue:

> Most speculation about the dangers of the population explosion are (sic) concerned with economic factors....There is another graver danger, the aesthetic danger. This may sound frivolous to some, but indeed it is not. On the organic, physiological, neurological, emotional response of man to his environment depends his health as a species.

Several authors have advanced the theory that a beautiful city is one which offers harmonious "built" scenes, and is also in harmony with its surrounding natural environment (Bacon, 1974; and Chermayeff, 1963).

In choosing a focus for community appearance change, the Extension team needed more than a philosophical definition of beauty. One source of inspiration is the appearance of some of the great cities of the world. In many of these older cities harmony resulted from "individual origin, growth and purpose...[and therefore]* ....The inhabitants [could]* respond to specific visual experiences with a sense of belonging, identification, and affection" (Chermayeff, 1963). *Added by this author.

The city of Portage, Wisconsin, provides an obvious example of how an area's unique character can become lost in modern development. The city has developed along an historic "portage" between the Fox and Wisconsin rivers. The route was so popular that a canal was finally completed in 1851 to facilitate the moving of goods from one river to the other. Today much of the canal is in a state of such ill-repair that it detracts from the appearance of the downtown area. In other places, housing along the canal has become equivalent to "the other side of the tracks." But, a few historic buildings along the canal have been preserved and the area has great recreation potential. Even if only the view from some of the city's many canal crossings would be improved, the perception of beauty in the city could be enhanced.

In addition to the resurrection of a city's historic character, the Extension team has defined several other design elements which can be used to augment the urban sense of harmony. These have been summarized in Table 1. Communities evaluating appearance needs of their urban area should consider: defining and organizing use patterns, relating city plans to the natural visual environment, the use of codes and ordinances, the use of plants, and the preservation of wildlife. The design elements included in Table 1 further illustrate the relationship between environmental concerns and community appearance.

Table 1: Elements of Community Appearance Design

I. Define and Organize Use Patterns
  A. Define public, semi-public, and private places
  B. Design public circulation areas to be appropriate to user (cars vs. pedestrians)
II. Relate to the Natural Visual Environment
  A. Preserve the natural environment that allowed the establishment of the city
  B. Give a high priority to a city's natural areas in master plan
  C. Design community to take advantage of or enhance local visual qualities
  D. Design buildings to take advantage of the visual quality of an area
III. Use Codes and Ordinances
  A. Upgrade or improve enforcement of local building and zoning codes that relate to visual quality
  B. Check sign ordinances to insure that they are designed to maintain the aesthetic value of an area
  C. Preserve scenic beauty through scenic easements, buffer zones, and landscape requirements
IV. Use Plants
  A. As privacy or "softening" buffers
  B. To mitigate the impact of noise pollution
  C. To cool and purify air
  D. To reduce ugliness and dust resulting from soil erosion
V. Preserve Wildlife Habitat
  A. To supply local nature experiences and visual variety (improve quality of life)
  B. To mitigate the impact of noise pollution
  C. By naturalizing existing urban open space
  D. Use zoning codes and planning to locate additional habitat.

Table 1 (continued)

E. Naturalize road and highway shoulders and median strips
F. Urban development should allow for the interconnection of wildlife habitat areas

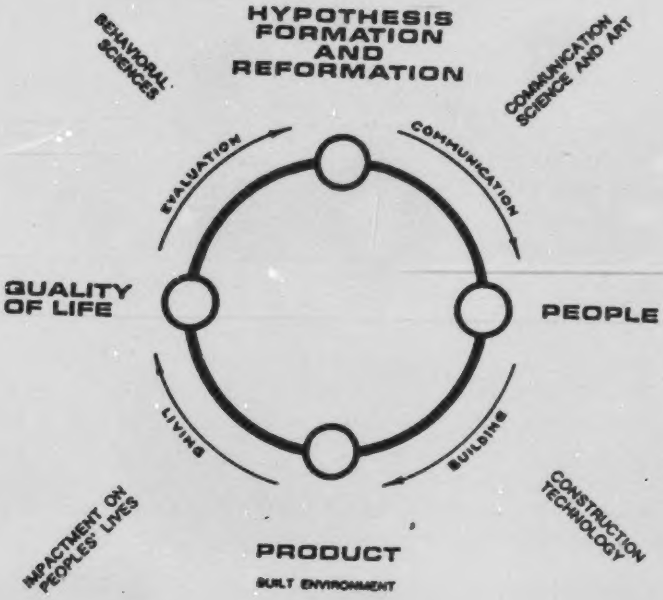
Educating Adults About Community Appearance

As educators and citizens, how are we to respond to the appearance of our urban life space so that we achieve the ultimate, a city or town with "a unique and personal expression of the activity and life within?" (Chermayeff, 1963). A traditional approach to this would require the organization and funding of workshops designed to meet the needs of appropriate officials and interest groups.

But what would motivate the "actors" in a community to participate in such an experience, and would the workshop experience itself motivate participants to act?

Edmund Bacon asserts that a successful community appearance project must include a relationship between the planner(s), the people, and the final built environment. He developed a diagram which describes the interplay among information, planning groups and citizens which should take place as an idea develops into an action (See Figure 1). A traditional community college or university lifelong earning course could not satisfy the organization and political requirements of this objective.

IDEA


HYPOTHESIS FORMATION AND REFORMATION
BEHAVIORAL SCIENCES
COMMUNICATION SCIENCE AND ART
EVALUATION
COMMUNICATION
QUALITY OF LIFE
PEOPLE
LIVING
BUILDING
IMPACTMENT ON PEOPLES' LIVES
CONSTRUCTION TECHNOLOGY
PRODUCT
BUILT ENVIRONMENT

ACTION

For the achievement of change in community appearance, motivation of appropriate persons and groups to act becomes the primary goal. The development of knowledge and skills in the action group can be acquired while actively pursuing change.

Learning through experience has been prescribed as a preferable learning process by several great educational thinkers such as John Dewey and Ivan Illich. Researchers and practioners in adult lifelong learning have echoed these sentiments. Summarizing his own research and comparing it to that of several others, Alan Tough writes:

> The single most common and most important reason for adult learning is the desire to use or apply the knowledge and skill. The commitment to an action goal....comes first: then comes the decision to learn certain knowledge and skill as one step toward achieving the action goal more efficiently and more successfully (Tough, 1969).

The extension of university research on community appearance into communities by the Wisconsin Cooperative Extension team has followed this suggested approach by teaching through provision of learning experience. In the community appearance project, adults learn by identifying problems and working on solutions with the support of resource persons.

The adult education techniques which are utilized by the project team are described in Table 2. The categories employed as educational objectives are derived from those described by William B. Stapp and others as necessary for the achievement of education about the environment (see the Belgrade Charter, 1976). The steps in the learning action sequence are derived from the professional experience of the project team and its application in the first two communities of the project study, Portage and Monona.

Obviously, the "Learning Actions" outline does not indicate the intricate steps of community organization which are required to implement each stage of the sequence. Because the character and needs are so varied from community to community, the intricate steps cannot be easily summarized. The project team must rely on one or two local leaders (such as an Extension resource agent) to provide information on appropriate organizational techniques and to provide names for the initial leadership group.

Although the entire "Learning Action" Sequence would be better understood by the reader if detailed examples were offered, due to space limitations only a few items will be explained.

Specific information gathering (Learning Action #5) and community organizing techniques (Learning Action #9) that have been chosen for use in the four-year appearance project have been demonstrated to be effective through past research. During the project, they will be combined, revised, and expanded as appropriate to the needs of each community. Information surveys include design surveys (Spreiregen, 1965), an appearance survey (Murray, 1970), and a community consensus survey (Mieller, 1979). Andre DelBecq has described the nominal group process technique procedure (DelBecq, 1963).

Table 2. Adult Education Techniques Utilized to Facilitate Community Appearance Change

Educational Objectives		Learning Action
	1.	Spearhead team includes knowledgeable and skilled professionals.
	2.	Spearhead team identifies general areas of community concern about community appearance.
	3.	Spearhead team identifies an initial local leadership group (such as citizens from local government, local business, local interest groups).
Awareness Motivation	4.	Spearhead team interests local leadership group in the possibility of problem solving or the use of current community actions is explored.
Skills Motivation	5.	Spearhead team assists local leadership in choosing or designing appropriate community appearance and community interest surveys.
	6.	Local cable access volunteers are invited to design surveys and to document program.
Awareness (for new individuals)	7.	Initial leadership group is expanded at their advice to include representatives of other groups important to action.
Knowledge	8.	Spearhead team presents survey results to expanded leadership group.
Skills Motivation	9.	Spearhead team employs the nominal group process techniques to assist expanded leadership in identifying problem areas and potential actions. Subcommittees may be formed.
Awareness Knowledge (for general public)	10.	Local news media reports results of surveys and nominal group process meeting.
	11.	Professional resources are "employed" to explore initial action possibilities (members of spearhead team, Extension professionals, university class project or student work-study -- salary may be paid through the professional's current position or through grants).

Table 2 (continued)

Knowledge Motivation	12.	Results are discussed with appropriate governing bodies if government action is required, shared with members of groups represented in leadership group and with the general public.
Awareness Knowledge	13.	Media and cable access report information to broader public.
Awareness Knowledge	14.	Spearhead team offers awareness experience workshops at low cost to general public. Topics chosen to emphasize elements of local appearance character and relationship of the built environment to the natural environment.
Awareness Knowledge	15.	Media publications and reports on awareness workshops.
Motivation	16.	The awareness and knowledge of the general public generated through participation in surveys and workshops and through exposure of ideas expressed through the media provides political support for action by leadership groups.
Knowledge Motivation	17.	Low-cost professional assistance offered to individual business owners (student work-study or grants).
Awareness Knowledge Motivation	18.	Actions taken by a few stimulate further actions.

Learning Actions #10 and 13 require the active participation of local media. Although the use of the news media as a conveyer of education is dubious, Peter Sandman reports that the news media can be useful.

> There is plentiful evidence that the media audience absorbs the 'agenda' of the newspaper front page and the TV news far more completely that it absorbs their content. In this sense, the mass media tell us not what to think, but what to think about. (Sandman, 1974)

At the least, we can assume that we can rely on the news media to create awareness among some segments of the population and, at the minimum, to provide knowledge to those who are already interested in the topic.

Organizing a community appearance project so that "Learning Action" #11 can occur is vital to the project's success. Each community must have its own original study. In Portage, the expertise was provided by a class of enthusiastic community design students and their professor. The class spent one-half semester in analyzing the appearance needs of Portage and developing possible solutions.

In summary, the education techniques which are utilized in a community appearance project begin with the motivation of a small leadership group whose membership has a high probability of taking action. As the group's actions lead to their acquisition of knowledge and skills, a larger and larger part of the public is drawn into the interplay. Finally, an aware citizenry provides the community spirit which provides peer support to persons or government units who have gained the knowledge and skills to act.

Results in Portage, Wisconsin

Fifteen months after the project team made initial contact with Portage leaders, one of the areas targeted by the leadership group as needing improvement has been purchased by developers, rezoned and rebuilt for retail use. Plans for change in the appearance of particular businesses in the business district are well underway, and the educational procedure continues as video tapes of student studies are shown to a variety of business, government, and community groups.

Other successes include the involvement of the news media, capacity attendance at community awareness workshops and the funding of a consultant by the Portage Chamber of Commerce and business owners.

The project met with one major failure -- no funding, to date, has been obtained to improve the appearance of the historic canal area (which was identified as an important local interest in "Learning Action" #9) in spite of several attempts. Positive action on that issue will take continued efforts on the part of a local interest group.

Conclusion

The field of adult environmental education is in need of adult learning projects which can lead to environmental change as well as increase an adult's awareness and knowledge of an environmental issue. The community appearance project in Portage takes advantage of economic and quality of life incentives to motivate adults to participate in an educational experience where they become aware, knowledgeable, and skilled. The final results of such an educational experience can only be measured over time. But the variety and number of community appearance activities which are now taking place in Portage compared to the one project which had been started before the appearance project was initiated show that the Portgage community appearance project was affective in initiating action. The success of the Portage project would indicate that other adult environmental education programs could, and should, be successfully designed around an action project.

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Paper Number 3

Bainer, Deborah L. "The Influence of Religious Background and School Philosophy on Moral Reasoning in Selected Columbus High School Seniors." School of Natural Resources, The Ohio State University, Columbus, Ohio 43210.

Educators recognize that a number of factors influence the level of reasoning employed by individuals when making decisions. In order to prepare students to make environmentally wise decisions, these factors must be identified. This study attempted to determine if the Judeo-Christian tradition, when part of the individual's religious background and when incorporated into school philosophy, influenced the level of decision-making of high school seniors (N=130) in sociomoral and environmental issues. Subjects from four public and private schools in the Columbus (Ohio) area completed three instruments: (1) the Defining Issues Test (DIT), which, based on Kohlberg's moral dilemma series, measures a preference for a particular mode of reasoning in moral issues; (2) the Environmental Issues Test (EIT), which measures thought patterns and processes using dilemmas set in an environmental rather than general social context; and (3) a Student Survey which collected demographic information, including educational and religious background. Statistical analysis indicated no significant ($p \leq .05$) difference between the level of sociomoral development between public (N=78) and private (N=52) school students. Public school seniors scored significantly ($p \leq .05$) higher in environmentally-related issues. Religious involvement did not correlate significantly with DIT or EIT at the .05 level. Regression analysis showed EIT P score, science courses, and religious affiliation as significant predictors of DIT P score. Significant predictors of EIT P score were DIT P score, public school attendance, religious affiliation, and female sex. Results of further analyses using log linear analysis and implications of the findings will also be discussed.

Paper Number 4

Baldwin, John H., Paul M. Ciminello, and Nancy E. Duhnkrack. "An Incentive Approach to Riparian Lands Conservation: A Case Study." Department of Planning, Public Policy and Management, University of Oregon, Eugene, Oregon 97403.

Riparian (adj): of, pertaining to, situated, or dwelling on the bank of a river or other body of water. Riparian lands are important for fish and wildlife habitats, for water quantity and quality, and for their diverse agricultural, grazing, forestry, and recreational uses. In addition, riparian zones act as a sponge to reduce flooding, stabilize streamflow, increase acquifer recharge, minimize erosion and sedimentation, and improve anadromous fish runs. (See Thomas, et.al., 1979; U.S. Fish and Wildlife Service, 1971.).

Riparian zones are also areas of heavy use (and abuse) and it is estimated that 70-90 percent of all natural riparian ecosystems in the United States have been destroyed (CEQ, 1973). In some areas, such as the Sacramento River, 98.5 percent has been lost (Warner, 1979). The primary reasons for this destruction are present livestock grazing practices, mining, road construction, clearcutting, and recreational uses. Despite their destruction, riparian habitats are extremely resilient. Practices such as fencing off livestock have shown dramatic stream improvement and implementation of simple land-use and recreational procedures and regulations have improved heavily-used areas (Clair and Storch, 1977).

This understanding of the benefits of healthy riparian habitats and the present need for their protection provided the impetus for the passage of Oregon's "Riparian Tax Incentive Program" (SB 397). Similar programs designed to improve these critical ecological areas were already being implemented by concerned federal and state agencies, but these agencies had no jurisdiction over private lands.. And it was on these private lands that much of the damage was being done.

SB 397 provides two distinct incentives for landowners to voluntarily improve unhealthy or maintain healthy habitats. First, there is a complete ad valorem property tax exemption for land up to 100 feet from the waterway, and second there is a 25 percent income tax credit for costs incurred by the landowner for agreed-upon habitat improvements. The legislation provides for two restrictions in determining qualifying lands. Only lands within a county with an approved land-use plan and only lands that are zoned as either agricultural, forestry, or rangelands can qualify.

The legislation had no active opposition, and had a broad base of support from conservationists, fishermen, ranchers, and members of the timber industry. Further, the Oregon Department of Fish and Wildlife (ODFW) offered to implement the program, incurring no additional administrative costs, which helped influence legislators wary of the fiscal impact of the program. As such, the legislation was the only property tax exemption to pass during the 1981 session of the Oregon Legislature.

In theory this program has many merits. It is based on incentives for the landowners who participate, it is voluntary, and it is administered at low costs by a respected state agency (ODFW). Further, the ODFW chose to administer the program primarily on the local level, using their District Biologists to interact and, hopefuly, come to an agreement with the landowners, thus adding the merits of flexibility and primary "local" control.

Practically, however, the program is not as effective as hoped. On a statewide basis, the ODFW's efforts have been hindered by the fact that only 16 of 36 counties have state approved land use plans, forcing the ODFW to implement the program county by county. Lincoln County, on the Oregon coast, was chosen by the authors to assess the effectiveness of the program to date because the ODFW heavily promoted the program in that county.

Surveys of over 30 eligible Lincoln County landowners and District Biologists from counties actively promoting the program found that the program was needed, and that the ODFW was the most qualified agency for implementation. However, both landowners and District Biologists stated several concerns regarding the program. Landowners who used their land primarily for grazing livestock (and damaging their lands) were not joining the program. It simply cost them more to join the program (through fencing and tree-planting costs) then they would receive in tax returns. In addition, landowners were suspicious of public agency controls on private lands. They were hesitant to sign a legal contract with that agency, doubted the program's effectiveness because of ignorance or criticism from other concerned organizations, and questioned the appropriateness of such a program in areas of high flooding (thus damaging or washing away any improvements made). The District Biologists echoed these concerns and added that present zoning restrictions, which excluded rural residential landowners from participating in the program, were hindering the program's potential effectiveness.

It was found, in essence, that only property owners who were required to do little to their land, or were retired, were participating. Thus, healthy riparian lands were being maintained, but the areas where the most damage was being incurred (large livestock grazing tracts) were remaining untouched.

Several changes are recommended to deal with these problems and improve the program. The first are suggestions that would require administrative action. Because the major obstacle to landowners is the cost of fencing, it is recommended that the ODFW (with the assistance of other concerned public or private agencies) make available, on an experimental basis, low-cost or free fencing. A second recommendation is that the ODFW more effectively use the skills of other concerned governmental and private agencies to expand the depth and breadth of knowledge about the program. Third, a Program Advisory Committee should be formed to assist the ODFW in proper and effective implementation. Finally, independent legal services should be made available by the ODFW to interested landowners.

Recommendations that would require legislative action include: 1) amending the present zoning restrictions to include appropriate rural residential landholdings, and 2) increasing the direct benefits (both per acre property tax relief and income tax deduction for improvements) to the landowner. Finally, it is recommended that the ODFW vigorously pursue this worthwhile program and commit the necessary resources for program evaluation and development.

The Oregon Riparian Tax Incentive Program is currently the only incentive-based program in the country designed to encourage improvement of private riparian lands. This program is voluntary, incentive-based, flexible, minimal in its fiscal impact, directed towards healthy as well as damaged habitats, and is implemented primarily on a local level. In addition, our research has shown that an effective program should include: statewide implementation, active involvement by all concerned public and private organizations, incentive levels that will entice interested landowners, zoning restrictions that will include all appropriate lands, readily available legal services to property owners, and continual program evaluation.

Incentive based land conservation programs may become an important new (non-controversial) method for the preservation of unique or sensitive lands. Oregon's program, serves as a model and case study for the development of similar programs in other states.

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Paper Number 5

Beiswenger, Ronald. "Creating an Environmentally Involved Citizenry: The Role of Environmental Educators." Department of Geography, The University of Wyoming, Laramie, Wyoming 82071.

The role of environmental educators in creating an environmentally involved citizenry is examined in relation to the Cheyenne Water Project, a controversial proposal for a transbasin diversion of water to supply the needs of Cheyenne, Wyoming. Written responses to an EIS and political advertising during a bond issue election campaign are analyzed to identify ways environmental educators might contribute to more effective public involvement in issues of this type.

Paper Number 6

Berberet, William G. "Forging an American Environmental Consciousness: The Historical Interplay of Technology, Politics, and Economics." Dean of the College of Liberal Arts, Willamette University, Salem, Oregon 97301.

Americans have ambivalent environmental perceptions, resulting from the complex interplay of belief system reflected historically in the experience of the western frontier and industrialization. One major cause of this present day ambivalence is the historical practice of rationalizing economic activities in terms of democratic political values. Paradoxical views of technology symbolize as well as any the fractured nature of our environmental concepts.

This paper seeks to explain American environmental attitudes as logical products of our historical experience as a people. The paper assumes that such an understanding is a necessary step in shaping a relationship between technology and society which is compatible with environmental protection.

Paper No. 7

Richard J. Borden. "Technology, Education and the Human Ecological Perspective."[1] College of the Atlantic, Bar Harbor, Maine 04609.

In a recent review of the history and possible futures of ecology, the eminent British biologist E. Barton Worthington has proclaimed: "Human ecology is coming of age" (1982). The inception and enlargement of ecological perspectives, however, has been a protracted affair involving numerous insights, disputes, and reorientations.

The Ecological Century. Though many ecological notions have been traced to pre-Socratic philosophy as well as various Native-American and non-western ways of thought, the stage for modern ecological thought was not firmly set until the publication of Darwin's Origin of the Species in 1859. Additional foundations were laid with Humboldt's Kosmos, Huxley's Man's Place in Nature, and Haekel's Natural History of Creation.

In its early versions, "Oecology" -- Haekel's initial "O" was gradually dropped -- centered primarily on exploratory and descriptive studies of the distribution of plants. The approach was soon extended to zoology and procuced animal ecology. In time, the concept and term "ecosystem" gained respect and usage, and with a wide range of ecosystems having been described, ecology assumed an increasingly important place in biology. A whole family of new concepts appeared and found useful currency: Mutual interdependence, symbiosis, food chains, web of life, succession, dominance, competition, balance of nature, and so on.

Human Ecology: From Discipline to Perspective. Shortly after the turn of the century, ecological ideas began to find their way into the disciplines concerned with human societies. In geography they were captured by G.G. Chisholm in Britain and H.H. Barrows in America, who adopted the term "human ecology." The term itself appears to have been first used by the University of Chicago sociologists Robert Park and Ernest Burgess who were influenced by the biological ecologists; as was Roderick McKenzie who drew heavily on Clements' earlier theory of plant succession. Amos Hawley, a student of McKenzie, did a great deal to further advance the ecological theme within sociology by extending it to population movements, organizational changes, and community structure in urban societies. Anthropologists were likewise enamored to ecological orientations which first appeared in Kroeber's studies of plant use by Native Americans, Steward's "cultural ecology," and which were later voiced in academic journals like Human Ecology, which still carries a decidedly anthropological tone. During the 1940s and 1950s ecological themes were introduced to psychology through Kurt Lewin's phenomenological field theories and Roger Barker's behavioral studies of "psychological ecology."2

With the advent of Earth Day 1970, ecology stepped beyond a strictly scientific perspective and into human affairs and politics as it became popularized by the "environmental revolution." By 1975, in fact, ecology in some form or other had found its way into nearly every academic field from literature and music to architecture, economics, engineering, political science, and psychology.

By a decade ago, the term "Human Ecology" has been embraced as a name for several university and college programs at, among other places, Cornell, Rutgers, Michigan State, Maryland, Howard, Hunter, and Connecticut College. For the most part, however, this was usually a surface change for previously limited-domain schools of home economics, anthropology, public policy, or architecture and landscape design that wanted to highlight or enlarge their ecological and interdisciplinary trends. While these programs continue to this date, virtually all of them have fallen short of a complete gathering of perspectives. The long history of competition among departments, their specialized assumptions and languages, an emphasis on narrow professional training, and isolation in separate academic buildings have apparently made a truly broad-based interdisciplinary program of human ecology difficult to realize within the modern university. Thus, while universities have evolved a means of offering a universe of perspectives, they have not developed an arena for integrating them. There is, in some sense, a hollow core at the center of the university system of education.

Recent reconceptualizations of education and the role of ecology in it have come full circle on the question of human ecology. Rather than viewing it as one or another traditionally defined field that is informed by ecological concepts (providing for a narrowly focused biological or human ecology) a few educational leaders have proposed an involution of traditional academic divisions with ecology's core assumption of interrelatedness. In these terms, human ecology is freed from the constraints of any single discipline and as V.G. Sheddick (1972) states, "human ecology became not a discipline as such, but more an attitude of mind." In other words, human ecology finds itself evolving over time from "an ecologized discipline" to an ecological approach to knowledge -- or "a human ecological perspective."

Education: The Ecological Ideal. As factual support for ecological interrelatedness mounted, many educators were compelled to criticize the apparent over-emphasis on specialized training. Some outlined complementary guidelines for rigorous, ecologically based, interdisciplinary education. This kind of education -- in the eyes of educators like Mark Terry (1971), James Swan and Bill Stapp (1974), Joel McInnis and Don Albrecht (1975), Tom Tanner (1974), and others -- is summarized by Leff (1978):

> (It)...should aim to increase not only environmental knowledge and awareness but also ecological systems thinking, ecological consciences, and other aspects of pro-life value systems, and the motivation and ability to take action in accord with all this. Procedures for effectively accomplishing those aims should include: training for problem solving and using active inquiry methods; organizing the total curriculum in as interdisciplinary a fashion as possible; incorporating values clarification as an integral consideration in teaching; encouraging student participation in decision making (that is sharing power with students); making environmental issues and concerns pervasive throughout the educational curriculum (both horizontally across subject areas and vertically across levels); using cooperative goal structures for students; making use of the whole community and helping students to relate environmental studies to actual local environmental, political, and social issues; and involving students (and teachers) in action projects that include striving for pro-life changes both in the school and in the broader community. (p. 309)

This is an enormous task and one fraught with dangers, impediments, and a generally countervailing ethos. The chief danger is that if human ecology means "everything" it means nothing. And even if it doesn't pretend to be all-encompassing, the vastness of its mandate makes conventional standards of academic rigor clearly inapplicable. As Prince Philip stated in the launching of the First Commonwealth Conference on Human Ecology in Malta, "It is an immensely difficult subject as it involves value judgments, conscience, and a whole mass of conflicting interests. I suspect that the sheer complexity of the problems has tended to discourage people from tackling them" (1970). How can someone tell if they are a good human ecologist, a competent generalist, or a dilettante "piddling in every puddle." They can't. There are, so far, few standards and the impediments are many, long-standing, and often concrete. They reside in our educational and social institutions, in our metaphysics and mythology, within the history of human ecology itself, and likely as not in the very nature of human thought.

Impediments: "Noise" at the Edge of Our Paradigm. Humans, like bees and beavers, have been a species of builders -- wall builders. As Freud and Jung so clearly pointed out, we even build walls within the confines of our mind. These psychological barriers alter our perceptions, compartmentalize our feelings, and hide much of our own thinking from awareness. To further insure our personal privacy, we also construct physical barriers to relieve ourselves from the annoyances of others. A good wall -- six or so inches thick -- can completely free us from an awareness of the living, loving, fighting, and dying of our neighbors. Thus, physical walls reduce the immediacy and impact of others and become effective psychological walls.

As any student of the history of ideas knows, the strength of feeling that accompanies different conceptions of "the truth" is enormous. These contradictions have led to hot wars, cold wars, witchhunts, and monkey trails. Sometimes they are discussed and resolved. Other times a wall is erected to make it easier for the disagreeing parties to ignore one another. Matters of state take place in state buildings, matters of religion in religious buildings, and so on. Worldviews become separated for convenience, and often stay that way. What initially separates ideas to reduce dissonance, in the end produces deafness. When dialogue is attempted, it is usually a dialogue of the deaf who either attack the enemy's bastion or retreat behind thicker barricades.

Take, for example, the rise of the university. As Charles Homer Haskins (1957) points out, "our inheritance from the oldest universities...is not buildings or a type of architecture, for our earliest universities had no buildings of their own." They were guilds, held together by the "common life of learning." When finally they did acquire buildings, however, the walls were arranged so as to separate competing viewpoints -- to offer them as parts of a universal curriculum, but not to necessarily integrate them.

The modern university carves up reality into narrow slices for which it then demands separate pledges of allegiance. These are served up with a theme of individualism, competition, and careerism which leads directly to bread and butter. Instead of providing education as a means of enhancing life, "the actual goals of our schools mainly involve producing people who will perform well at work that is extrinsically motivated" (Leff, 1978). To do this is to specialize. This fractionation of knowledge extends throughout the educational system from grade school through graduate school. It is the "subject" approach to education which leads to academic majors and professionalism in practice. Modern students believe that they are having an "identity crisis" if, by the time they are 20, they don't know what they expect to do for the rest of their lives. Should they choose what they hope is a "life of learning," and return to the universities, they are required to stay within some department or other -- where the pressures for specialization become even more intense. If, as Paul Shepard states, human ecology "will be healthiest perhaps when it's running out in all directions," then there are surely very few places for it in contemporary education.

There are other impediments beyond these architectural and institutional ones. Of special interest are the psychological byproducts of technology. The efficiency which we have invented to govern our mechanical systems is being applied, through narrow social science, to our social and psychological systems. The development and perfection of "technique" has allowed us to isolate and serve false needs. Obvious examples of these refinements and amplifications are the sugar, alcohol, and drug products that have become themselves serious social and medical problems in contemporary society. These "super-stimuli" are so strong that it is almost impossible to withdraw from using them. Science and technology have provided us with methods for maximizing certain variables by taking them out of their natural contexts. When these techniques are turned on us, we become victims of our own methodologies. Advertisers work to develop superstimuli that they hope may be so powerful that we will be seduced by their mere presence. When we walk into a food store, we don't see food. We see carefully placed, elaborate and highly colored packing. All of it, to be sure, is the outcome of countless studies of perception, memory, and behavioral orientation. Science's once esteemed goals of prediction, understanding, and control are used in a very narrow sense that is usually in service to the marketplace in these matters. The problem is compounded by the fact that this level of superstimulation puts many people at the mercy of hidden psychological persuaders. Throughout the third world, American travellers are constantly amazed at the availability of Coco-cola, transistor radios, television, and all sorts of brightly colored plastic junk. People orient to these souped-up stimuli and find them very compelling. We have some weakness for such things. Technique takes advantage of these weaknesses and abuses human sensitivities and needs. Human ecology, it seems to me, seeks to restore a fuller use of human senses and encourages the enhancement of a more mutually beneficial human-in-habitat liveability

Outline for a Healing Perspective. In effect, what the human ecologist must do first is to confront the vast progression of ideas that have become increasingly differentiated and compartmentalized. Over time, lines of thought have produced arbitrary boundaries that separate them and which now call for new fusions. It is the role of the human ecologist to draw on these strands of specialized knowledge and weave new meta-disciplinary perspectives. By breaking down barriers and opening communications among differing fields, human ecology also seeks to overcome and resolve the classical bifurcation of nature into worlds of facts and values. It uses the vehicle of "human-environment relationships" as a springboard for approaching the world as a total organism in which traditional dualities -- the organism and the environment, the knower and the known, determinism and freedom, and so on -- can be overstepped and dissolved into new patterns of order and meaningfulness. From this new perspective the human ecologist extends and infuses the essential notion of interrelatedness from ecology to areas of knowledge beyond the biological sciences. Within this context of an interrelated whole it aims to realize how order arises from randomness, spirit from matter, person from impersonal stuff. The ultimate goal is to discover the ways in which organisms adapt to and create better relationships with one another and their environments so that humans might do the same.

But human ecology requires perspectives difficult to acquire or practice within the confines of traditional academic and professional specializations. Parts need to be continually related to wholes, analysis and synthesis become alternating emphases in a single continuous experience. It involves exploring the subjective and aesthetic implications of ecology which Dasmann (1974) considers the "one science that seems capable of assimilating moral principle and visionary experience." It requires relating artistic and natural forms and examining the historical and psychological roots of our attitudes toward humans and nature. The requirements of a human ecologist are "...the openness towards experience, the ability to tolerate paradox and ambiguity, to perceive order in disorder, and the willingness to recognize that the enemy is yourself wearing a different mask. What human ecology has to do is to reconstruct a world view in which the mental and physical are reunited... (It)...is our main philosophical goal" (Carpenter, 1983). Beyond these personal attributes, human ecologists must also try to figure out a variety of ways to so arrange affairs that we as individuals with different backgrounds, skills, and knowledge will come together to focus on common questions and problems as a collective enterprise. In this enterprise, I trust, we will find a better basis for educating rather than abusing our needs, as well as finding and judging the pace of technology in the human ecological system.

Footnotes

1. The reader is reminded that this paper is an abbreviation of a longer manuscript. The integrating context has been sacrificed in many instances and only a few of the "bare" ideas are gathered here.
2. Several excellent reviews of the history of human ecology have been published. See, for example; G. Young, 1974. "Human Ecology as an Interdisciplinary Concept: A Critical Inquiry." Advances in Ecological Research, 8, 1-105; J. Bruhn, 1974. "Human Ecology: A Unifying Science." Human Ecology, 2, 105-125.

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Paper Number 8

Briss, Dorothy C. "We Have Met the Enemy." Hastings Junior High School, Columbus, Ohio 43221.

In this workshop participants will play a simulation game, a re-creation of the War of 1812 in the Great Lakes region. Game cards and original source materials are designed to help secondary students identify with people, places, and problems from American and British military and naval viewpoints. Students think about reasons for war, problems of supply, factors in winning. Participants will receive game materials. Consider adding this historical perspective to your students' aquatic education.

Paper Number 9

Champeau, Randall J. and R. Ben Peyton. "Development and Testing of a Percieved Environmental Control Measure." Geography Dept., University of Wisconsin-Eau Claire, Eau Claire, Wisconsin 54701; Dept. of Fisheries and Wildlife, Michigan State University, East Lansing, Michigan 48823.

1. Introduction

Locus of Control (L of C) was introduced as a component of Rotter's Social Learning Theory (1954). It identifies a personality dimension that may be used in conjunction with other variables to explain and/or predict human social behavior (Rotter 1975, Phares

1976, Lefcort 1976). Locus of Control is briefly defined as the "expectancy for reinforcement" or the "probability held by the individual that a particular reinforcement will occur as a function of a specific behavior on his part in a specific situation" (Rotter, 1954). Arbuthnot, 1977; Tucker, 1978; Levenson, 1972; Smith, 1979; Peyton and Miller, 1980 have suggested a relationship may exist between L of C and environmental action taking behavior.

The purpose of this study was to construct a situation specific L of C instrument which could be used to measure the perceived expectancy (L of C) of an individual for taking specific types of environmental action in a given situation (Champeau, 1982). The instrument designed in this study was entitled the Perceived Environmental Control Measure (PEM).

2. Procedures

Initially an item pool was developed with an equal number of statements in three L of C belief orientations: 1) Internal (I); 2) Powerful Others (P); 3) Chance (C). These three belief systems which were originated by Levenson (1972) were in turn applied equally across five categories of environmental action; 1) Legal Action; 2) Persuasive Action; 3) Political Action;; 4) Ecomanagement; 5) Economic Action. Subjects were presented a description of a solid waste environmental issue and asked to respond to the PECM statements as they pertained to that situation.

Selection of the final 45 PECM items was based on analysis of data collected from two pilot studies. The final PECM was subjected to a series of field tests to assess the instrument's reliability and validity (i.e., content and construct validity). The instrument was also used to further explore some proposed relationships that might exist between environmental action taking behavior and L of C beliefs. Participants in the study include sample populations of college students, Sierra Club members and K-5 teachers.

3. Major Findings and Conclusions

The PECM exhibited initial evidence of reliability validity and has added further substance to the proposed relationship between Locus of Control (L of C) and environmental action taking behavior. As theory would predict, reported environmental action taking increased with the subjects' perceived ability to personally apply similar environmental actions toward the remediation of the described environmental issue. Similarly, the PECM showed some potential for discriminating between an environmentally active group and other groups not necessarily identified with environmental activism.

In addition to the above, this study provides evidence that the majority of subjects perceived themselves as having some personal control over the stated issue(s). However, chance and to a large extent powerful others, have been identified as agents which subjects also perceive as having some control over the outcome of the issue(s). These findings seem to endorse the assertion that the Internal/External (I-E) construct functions as a multi-dimensional construct, at least with respect to the stated environmental issues used in this study..

Findings also support evidence that subjects perceived themselves to have more personal control in the issues when using some types of environmental action that with others. Subjects showed a tendency to feel relatively more in control with "take it to court" or legal action process than with other categories of action.

Finally, it seems that sex, age, and/or occupational background may have some relationship to perceived control of environmental issues. Analysis of data from the largest sample group in the study (N=81) indicated that males scored significantly more external than females. Also, it was discovered that teachers and college students of this study had differing degres of perceived personal control over the solid waste issue. College students scored significantly more internal than teachers.

Ultimately, the above findings have many implications for environmental education researchers and/or educators. Some recommendations based on this study are presented below.

Summary of Recommendations

1. Results of this study support the proposed relationship between Locus of Control (L of C) and environmental action taking behavior and justify further research in this area. Specifically, the inferred relationships between internality and environmental action taking behavior as proposed by Peyton and Miller could be addressed in further research.
2. The Perceived Environmental Control Measure (PECM) has shown potential for determining relationships between L of C and environmental action taking behavior. Continued research to assess the usefuness of the PECM is needed. Future research should also analyze total PECM scores in addition to the various subscale scores. Such an analysis enhanced the findings of this study.
3. Field testing of the final PECM was limited by small sample sizes and/or lack of random sampling. Similar field testing should be conducted with larger samples collected from a variety of populations.
4. The PECM should be correlated with results from a more generalized L of C instrument administered to the same sample. Such testing might help determine if the situation-specific PECM has a potential diagnostic advantage over a generalized instrument with respect to environmental action.
5. To determine the flexibility and/or generalizability of the instrument and results, the PECM should be applied to a variety of environmental issues. This would refine our understanding of the situation-dependency of the L of C dimension.
6. Given the PECM's intended use (i.e., to aid in explaining environmental action taking behavior) it would be pertinent to subject the PECM to a study that further tests its predictive validity. This would enhance the usefulness of the instrument in evaluating the effectiveness of EE curricula to increase responsible environmental acting taking.

7. Locus of Control is only one variable that may interact with others to promote or inhibit the environmental action taking behavior of an individual. A simultaneous assessment of L of C along with other interacting variables (i.e., value of reinforcement, knowledge of issue) may provide an enhanced perspective on environmental action taking behavior.

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Paper Number 10.

Chaudhri, Dr.Man Mohan. "Educational Technology in Indian Education." Head, National Council for Educational Research and

Training, New Delhi, India.

The presentation describes the Indian educational system and some of its problems. It reviews the application of educational technology over the last three decades including the Satellite for Instructional Television Experiment in 1975-76. It analyzes the use of media such as films, television, radio, audio cassettes, slides, charts, and models in various teaching learning situations. 1976

Three basic conclusions are developed: that at present, (a) technology is ahead of the capability to produce educational software, (b) technology is ahead of the educational management system, and (c) the educational system needs to be vocationalised in a way to provide jobs for rural India (75% of the population) for a community to develop itself.

The paper then looks at the innovative experiment of education taking place at the rural level and proposes a model for optimum utilization of educational technology through the radio terrestrial system and the INSAT-IB (Indian satellite) to be launched towards the end of 1983.

Paper Number 11.
Clausen, Bernard L. 'OUTLOOK, A New Piagetian Based Environmental Education Program." Department of Biology, University of Northern Iowa, Cedar Falls, Iowa 50614.

OUTLOOK is a new type environmental education program designed with an educational philosophy and methodology derived from the research of Piaget and Karplus. The program includes 140 curriculum enrichment activities created by teachers and published in grade level sets for K-2, 3-5, 6-8, and 9-12. A specially developed inservice workshop is a significant component of the program. OUTLOOK is sponsored by the University of Northern Iowa, Iowa Department of Public Instruction, and Iowa Natural Heritage Foundation. The program grew from long experience with the Iowa Teachers Conservation Camp and the concepts expressed in Environmental Education Process for Iowa Schools by Clausen and McCalley published in 1978 by the Iowa Department of Public Instruction.

Teachers in the elementary and secondary schools have identified a serious need for an environmental education program which progressively moves the learner through environmental awareness, knowledge of environmental principles and resource management techniques to an understanding of the environmental policy decision making process. Such a program must be locally relevant, capable of integration into any subject area where teacher interest may occur, recognize learner abilities and be a vehicle for accomplishing instructional objectives in the basic skills.

An extensive study of available environmental education materials and programs was conducted to identify deficiencies and clarify new directions which appeared to be needed. OUTLOOK is a program created as a system rooted in accepted educational theories of how individuals learn. The OUTLOOK system implements the concepts of Piaget, who identified levels of learning readiness and the learning cycle which was formalized by Karplus. The system incorporates into the activities eleven topic spheres and six themes which inter-relate the spheres.

Topic Spheres

- Production and Distribution
- Community Responsibility
- Popular Dynamics
- Natural Habitat
- Air
- Water
- Mineral Resources
- Heritage
- Soil
- Land Use

Themes

- Aesthetics
- Energy flow
- Interdependency
- Life Style
- Stewardship
- Cultural Evolution

Each of the four grade level sets of activities contains 35 activity cards which are color coded according to sphere. The activity card presents behavioral objectives, methods and materials to be used, and a learning cycle of Exploration, Invention, and Application. Suggestions are given for further learning cycles which may be used as extensions.

In the Summer of 1982, an OUTLOOK writing workshop was held at the University of Northern Iowa under the direction of Dr. David McCalley. Thirteen teachers having experience and training in environmental education were selected to represent various grade levels, rural and urban schools, and different subject fields. The teacher-writers were formed into four writing teams to create the activities for the grade levels at which they taught. Each writing team was assigned its own editor who was a professional environmental educator. State agency personnel served as consultants to the writing teams. Over 300 Iowa teachers field tested the activities in a variety of teaching situations. Results of the field testing indicated enthusiasm for the approach and a need for only minor changes in some activities before publication.

Three hundred teachers were prepared to use OUTLOOK in eight one-week workshops during the summer of 1983 at the Conservation Education Center of the Iowa Conservation Commission. The workshops will be repeated in 1984 for an expanded number of teachers. Each workshop participant enrolled in two courses taught by University of Northern Iowa instructors. One course covered educational philosophy as applied to OUTLOOK including Paget's concepts and the development of the learning cycle. The second course provided experience with OUTLOOK activities and instruction on the integration of environmental education as an enrichment of the existing curriculum. Support for the workshops came from many local agencies and organizations.

Each teacher was required to integrate OUTLOOK activities into their own curriculum or course of study in a very specific manner. A rational for the placement of the activity was also required. This assignment virtually eliminated the well known gap between information dissemination and utilization in the classroom. In most instances the teachers used the OUTLOOK activities to replace more traditional approaches which did not involve environmental values and principles. Thus the participant's curriculum was enriched with environmental education without adding more material to the already crowded school program. Activities were used as introductions, summaries, bridges between units, or to restructure whole units in a more relevant manner.

A survey of workshop participants was conducted in the Fall of 1983 to maintain contact with the teachers and to identify any difficulties encountered in the actual implementation of OUTLOOK. Other forms of longer range follow-up are being developed to sustain the enthusiasm which was built at the workshops.

OUTLOOK has already attracted attention in other states than Iowa as well as in foreign countries. The activities were written and the overall program developed to be universally applicable. A global view is incorporated which will be useful wherever one is located. The producers of OUTLOOK can assist in the implementation of the program in any state, province, or nation by conducting inservice workshops and providing the activities. A workshop to train workshop instructors has been designed to allow other users of OUTLOOK to train their own teachers. The OUTLOOK activities are not available separately from the complete OUTLOOK program which is copyrighted. Persons interested in adoption of the OUTLOOK program are invited to make inquiry to Gerald Schnepf, Iowa Natural Heritage Foundation, 505 Fifth Avenuye, Des Moines, Iowa 50309.

Paper Number 12

Cobb, Thomas B. "Conservation As an Employment Source." Vice Provost for Research, Director of the Energy Studies Program, Bowling Green University, Bowling Green, Ohio 43403

Energy Production and use are most often associated with the creation of new jobs and frequently have been considered as sources of employment for local communities. However, the conservation of energy and the protection of natural resources are also connected with employment in a very positive manner in some cases even more strongly than energy production. Studies of various socioeconomic and technological factors relating energy production, conservation, and employment will be discussed with a view toward identifying specific areas of highest impact for creating new jobs.

Paper Number 13

Covert, Douglas C. "Communication Barriers in Environmental Education: Relationships of Diffusion Theory to Evidence of Rejection Decisions." School of Journalism, Indiana University at Indianapolis, Indiana 46202.

Efforts to increase the effectiveness and quantity of environmental education in classrooms by changing the professional behaviors of teachers met with limited success.

A study reported in 1982 found that intensive workshop training of teachers produced no significant changes in professional environmental education activities over a sixteen-month interval. The training was conducted in intensive, week-long programs. The study included 300 K-12 teachers measured before and after their workshop experience.

Diffusion is defined by Everett M. Rogers in Communication of Innovations (1983) as "The process by which an innovation is communicated through certain channels over time among the members of a social system." Diffusion research applies directly to the process of adoption of environmental education in classrooms and school systems. Decisions by individuals or groups to adopt or reject an innovation are a result of many influences. Some of those influences related to environmental education are discussed here and outlined below.

Major Adoption/Rejection Influences
I. Characteristics of Innovations
  A. Relative advantage
  B. Compatability
  C. Complexity
    1. educational processes
    2. environmental concepts
  D. Trialability
  E. Observability
    1. science facts
    2. personal behaviors
    3. long-term personal behaviors
    4. structured information
    5. knowledge of interrelationships
II. Adoption Process Stages
  A. Awareness -- need
  B. Knowledge -- solution
  C. Persuasion -- solution favorable to self and others
  D. Decision -- adopt/modify/reject; whole/part
  E. Implementation - behavior change
    1. working materials
    2. advice and assistance
    3. acceptance by existing social systems
  F. Confirmation -- reinforcement
    1. of self
    2. of and by subsystems
III. Pro-Innovation Bias, i.e., total and rapid adoption
  A. Uncertain compatibility
    1. regional variations
    2. local interests
    3. tradition
  B. Cultural and social systems disruptions
  C. Potential consequences

IV. Uncertainty and Dissonance
  A. Information-seeking behavior may:
    1. reduce uncertainty and dissonance or
    2. reveal incompatibilities
    3. reveal complexities
    4. generate replacement uncertainty
  B. Encourages selective adoption

V. Problems in Supportive Systems
  A. System norms
    1. peer groups
    2. school curricula
    3. community standards
  B. Centralized diffusion system
    1. materials
    2. techniques
    3. advice and assistance
  C. Frequent confirmation
    1. centralized diffusion system
    2. individual diffusion agents

VI. Networks
  A. Who interacts with whom on what topic?
  B. Network alienation fears

This paper introduces diffusion theory as one explanation of the lack of expansion of environmental education among teachers with strongly favorable attitudes. With impediments identified, methods may be developed for surmounting or circumventing diffusion barriers.

Paper Number 14

Cowan, Peggy. "Alaska Sea Week Project." Marine Education Coordinator, Alaska Sea Grant College Program, University of Alaska, Fairbanks, Alaska 99701.

1. Introduction

"Crossroads - Society and Technology," the theme of the 12th Annual Conference of the National Associaton for Environmental Education, is particularly telling of the situation in Alaska. A state most noted for its mountain vistas, salmon fishing and nature culture, it is currently dealing with an input and rationalization of diverse technologies. From the North Slope where industry is applying its most advanced technologies at Prudhoe Bay to extract oil; while 200 miles west the Inupiat people of Barrow are hunting bowhead whale in skin boats; to Fairbanks where cabin dwellers haul water in plastic jugs, use outhouses with styrofoam seats, burn wood cut with chain saws, to heat super-insulated homes, down the road from electric heated condominiums; to the southern coast where subsistence fishing people net salmon next to a modern international fishing fleet which harvests 90 percent of the fish caught in the United

States, the contrasts are striking. One educational approach to help students prepare for the critical decisions these contrasts portend is Alaska Sea Week.

2. History

Sea Week in Alaska originated in Juneau,15 years ago when parents were struck by the importance of marine resources to their children's lives, the ubiquitous nature of the sea in this port town, and the paucity of attention water topics received in their schools. They joined with teachers and resource experts in creating a week-long celebration of the ocean in the schools and community.

The marine and water environment is important to all Alaskans. The Alaskan coast is over 33,000 miles long, greater than the entire coast of the contiguous 48 states, and 5 percent of Alaska's people live along its shores. Financially, we depend upon fisheries and other marine resources such as oil. Most people who do not live on the coast live on the network of rivers and are surrounded by vast wetlands. There are over 3 million lakes in Alaska. Because of the water environment's importance to all Alaskans, the Alaska Sea Grant College Program sponsored a four-year (1979-1983) project to initiate Sea Week statewide. Today students in Kivalina celebrate Sea Week during their celebration with the salmon run. The Juneau and neighoring southeastern communities head for the beaches during a spring tide in April and May to explore their rich intertidal life.

3. Project Goals and Objectives

The goals of a Sea Week in a school are to:

- Develop within students a greater awareness and understanding of their state and local marine environment;
- Use community members as learning resources for the K-12 classrooms; as well as;
- Involve the local community in a celebration of their marine resources; and
- Use the local marine environment as a motivator for learning in all disciplines in the classroom and field.

The objectives of the Alaska Sea Week Project are to:

- Train teachers throughout Alaska to conduct marine education programs in elementary and secondary schools;
- Revise, edit, and print a K-6 *Alaska Sea Week Curriculum Series;*
- Provide ongoing support and inspiration to teachers, through the "Alaka Marine Educator's Newsletter," audioconferences, and advanced courses.

4. Project Components

The revised *Alaska Sea Week Curriculum Series* provides classroom and field activities, teacher background information and worksheets for K-6 teachers. Each level focuses on a different topic and is keyed for use in progressive grades, *Discovery* at Kindergarten and *Marine Mammals and Coastal Issues* at grade six. Because of the non-graded makeup of many Alaskan schools, the differing skill level of students at the same grade level, and the traditional grade level coverage of some topics in different communities, the books are not labeled by grade level. The topics of the volumes are:

Volume 1: Discovery
Volume 2: Sea and Wetland Animals
Volume 3: Shells and Insects
Volume 4: Native Uses of Seas and Rivers
Volume 5: Birds and Wetlands
Volume 6: Fish and Fisheries
Volume 7: Marine Mammals and Coastal Issues
Volume 8: Source Book

The Source Book provides information on aquariums, sea songs, field trip equipment and an annotated bibliography on films and books on all topics.

The original books were written for Juneau. The new revisions were revised using teacher conferences and classroom piloting, followed by editing and further review, and audioconferences of teachers, technical experts and the Sea Week staff. The books cover fresh and saltwater environments and provide activities for all disciplines.

The Sea Week celebrations in the schools are similarly multidisciplinary. Students do math problems about fish population levels; conduct scientific research on local beaches and rivers; write themes about boating safety and fishing adventures; and complete sea-faring art and music projects to decorate their school, and perform in Sea Week assemblies. Local community participation is invited and encouraged. parents, agency employees and Native elders demonstrate net mending, fish smoking, bird watching, and clamming. These resource people tell about their own careers and discuss local issues including marine mammals and fishery conflicts, oil development, coastal zone management, and habitat losses of productive estuaries.

The teacher training efforts occur primarily as teacher inservices and one- or two-credit courses. The inservices are usually one day introductions in the urban schools of Juneau, Anchorage, or Fairbanks, on their annual inservice days. In bush areas, school is dismissed for two or three days while instructors usually stay for another day to work with teachers and students in the classroom and on field trips. In other communities, the workshops take place on evenings and weekends. The teacher training, like Sea Week itself, accommodates itself to each region and community in Alaska.

Each workshop outlines the Sea Week project and objectives and provides tips on organizing a Sea Week. The workshops also have hands-on sessions which demonstrate lessons. Modelling of Sea Week activities also occurs by inviting local Alaska Fish and Game agents or Native elders to provide information, tell stories, or help on a field trip by demonstrating scientific collection techniques or traditional fishing methods. The workshops also have content sessions which make teachers more comfortable in their own expertise in the subject matter. There is always a field trip and some time for teachers to work with the curriculum and other resource books available Each workshop varies depending on the time allowed, locale, interests of the participants and expertise of the instructors. The Sea Week project has trained a "teaching pool" of district teachers, university professors, and parents to lead inservices.

Follow-up to the inservices is provided by the "Alaska Marine Educator's Newsletter," summer courses, and audioconferences. The audioconferences take place preceding the major periods of Sea Weeks, in the spring or fall. During the conferences, teachers from around the state call in from personal phones or report to audioconference sites, to share Sea Week ideas or questions with those from other regions.

Evaluation shows that Alaska Sea Week has been successful because: 1) it provides Alaskanized curriculum to teachers largely unfamiliar with the Alaskan environment; 2) each community has control of and can create its own Sea/River Week; and 3) the program introduces science in an unthreatening and a multi-disciplinary approach. Sea Week and the marine education is an effective method to bring environmental education to all students because the community and school-wide celebration involves even the most unmotivated teacher. Every class is a part of Sea Week in a Sea Week school, all students are reached, and many teachers go on to having a Sea Month or Sea Year.

Paper Number 15

Cowden, James W. "Decisions for the Great Lakes." Co-Director, Environmental Studies Program, Hiram College, Hiram, Ohio 44234.

The development of understanding and the achievement of change in a complex, geographically extended resource system, hampered by fragmented management, competing interests and technologies, unfocussed information and data, in an international context, has been approached by a citizen education program. The paper discusses the effort to create a bi-national constituency for the Great Lakes ecosystem; to teach the critical elements of science, the natural system, the institutional structure, the emergent socio-economic patterns, and resource management issues; to impart an orientation to the interdependence of fields and functions, of concern for the system to think relevantly; to provide a perspective on the inherent limitations of any decision process, and the relationship of bureaucracies to technology and its consequences. Techniques and concepts of the citizen as a resource in Great lakes planning and decision-making are taught. The course is a prelude to an expanding network of academically supported networks. Participant evaluation for the Lake Erie program is presented.

Paper Number 16

Dysart, Brent. "The Eastern Arctic - Little Known - Great Concern." Outdoor Education Consultant, Waterloo County Separate School Board, Kitchener, Ontario N2G 4G2.

In books and other educational materials, the Arctic regions have been described as a vast wasteland, barren, inhabited by self-seeking, poorly educated natives.

With the current exploration for energy, the Artic has become North America's new western (northern) frontier. It is also quickly becoming the new location for the recreation elite, the canoeist and backpacker.

This workshop examines some of the issues and concerns of the North. This cultural exploration through the eyes and heart of a "southerner" is a slide presentation of a "teacher professional development program" sponsored by the Council of Outdoor Educators of Ontario.

Paper Number 17

Dysart, Brent. "Great Lakes - True of False." Outdoor Education Consultant, Waterloo County Separate School Board, Kitchener, Ontario N2G 4G2.

Steeped in the historical development of our continent, the Great Lakes continues to play a significant role in the continent's commerce, recreation, climate, and as a major source of our fresh water.

How do we treat them? Dumping raw sewage and harmful chemicals into them! Can the Great Lakes continue to be the toilet of the continent? Are the Great Lakes receiving their due notice in our environmental curricula?

This workshop discusses some factors relating to these and many more questions about our treatment of the Great Lakes. The materials presented come from the Great Lakes Tomorrow organization and a research and development group from Waterloo, Ontario.

Paper Number 18

Fortner, Rosanne W. "Resource Controversies and the Law of the Sea." Coordinator of the Ohio Sea Grant Education Program, Division of Environmental Education, The Ohio State University, Columbus, Ohio 43210.

International boundaries in the Great Lakes and in the world ocean are the sites of frequent conflict over resource ownership and harvest. The governments claiming territorial waters naturally apply their own laws in governing those areas, with a resulting legal patchwork offering little assurance of international cooperation or resource protection.

A classroom activity entitled "It's Everyone's Sea -- Or Is It?" has been developed by the Ohio Sea Grant Education Program to teach students in grades 5-9 about problems related to the Law of the Sea. The United States-Canada boundaries in the Great Lakes and the Gulf of Maine are used as examples of how international boundaries are drawn over water. By involving teachers in a role-play simulation of a Law of the Sea hearing, this 45-minute workshop session will illustrate the complexities of governing the use of global resources.

This session is part of the Water Resources symposium and was presented by one of its coordinators.

Paper Number 19

Fritsch, Albert J. "International Appropriate Technology Cooperative Programs Linking Technical and Community Groups." Appalachia-Science in the Public Interest, Livingston, Kentucky 40445

Appalachia-Science in the Public Interest (Livingston, Kentucky), a member of the Appalachian Institute, has launched a "Global Highlands Appropriate Technology Program." This is meant to be the beginning of an appropriate technology transcultural network or informal exchange among the world's mountain people.

In early 1983 the program was started with a resource inventory of Peru by a four-person team composed of community developers, AT specialists and a person knowledgeable in Peruvian culture. The goal was to discover through an inventory of renewable energy and community service resources what programs could be worked out that would be mutually beneficial to all parties concerned. The team realized that a transcultural exchange is a true sharing, a learning and giving by all parties.

Peru proved to be an ideal starting place. It has an abundance of renewable energy sources; it has a large un- or under-employed labor force; domestic materials needed for energy alternatives are available (i.e., glass, copper, steel); insolation is excellent in many parts of the country (Arequipa, the second largest city, has an annual sunshine duration of 8.6 hours/day); and solar energy is needed to replace expensive firewood, dung, and kerosene. Nonetheless, Peru faces a number of serious social and economic obstacles (civil unrest, droughts, floods, high inflation, etc.) that will undoubtedly retard renewable energy development.

The team discussed alternative energy problems with over 60 governmental, academic, civil, and religious leaders and with members of rural cooperatives and urban "pueblos jovenes." The results of the inventory was reported at the June 1983 annual meeting of the American Solar Energy Society. Some 11 renewable energy sources were discussed in the light of a variety of human, technical, social, and political factors. The team concluded that the most promising candidates for future cooperation were solar water pumps for rural areas and community solar food cookers for urban groups.

Peru has an excellent beginning at AT work (e.g., the reed boats of Lake Titacaca, three-wheel bicycles, use of native building materials, and irrigation systems). Household construction is a do-it-yourslf variety with the people being quite proficient at modular building over a three- to five-year time period. Passive solar water systems are being manufactured in Arequipa, but the price is beyond the means of the low-income people.

A number of outside financed renewable energy projects have failed either due to improper building materials or lack of community support. For instance the government-sponsored (ITINTEC) solar desalination plant in arid Piura Department was dismantled within months after installment, by the local people. The demonstration project was not part of the community's own program. Many UNICEF-funded solar greenhouses have been abandoned when plastic glazing decomposed rapidly from the strong Altiplano ultraviolet radiation. On the other hand, a number of projects have been successful when communities were involved in planning and construction, and when local materials were utilized. The cooperative at Acora in Puno Department is a prime example of proper community and technical resource interaction.

Recommendations resulting from the resource inventory include:

a) Aid in the development of a Peruvian Technical Network to link resources within the country;
b) Train volunteers in AT techniques that might be useful in Third World countries. This is intended for two- to three-year overseas volunteers;
c) Perform short-term consulting work for special programs in the Third World country;
d) Bring selected community leaders to this country for AT training and information exchange. The preference is to work with communities and not individuals.

It was quite evident that merely sending technical experts who have no experience with Latin American culture into local communities might prove unacceptable.

Paper Number 20

Hakim, Md. Yunus Hussain. "Lesson from Plants - A new Interpretation of Ecosystems." Department of Geology, Samastipur College, Samastipur, (Bikar), India.

It is a pity that the majority of the Homo sapien race knows little about their environment. The best creature of God now suffers the worst from his own ignorance, vanity, disregard, and underestimation of human values. With his superior brain, man has tried to create a heaven on earth, but he didn't envision the hell that was being created in the form of environmental pollution. We have exceeded the threshold of pollution damage in many cases and the human race is caught in its own net. The need, of course, is for a new ethic of "use without abuse" of the limited resources of our spaceship-earth.

It is difficult to speculate whether the magnitude of danger resulting from nuclear warfare is greater than that resulting from environmental pollution. Will the huge quantity of explosives amassed by certain countries bring back our congenial environment or will it be a permanent danger for the distruction of the human race. The lesson from plants can perhaps provide some answers.

In photosynthesis, plants require carbon dioxide and give off oxygen. To respire, humans require oxygen and give off carbon dioxide . Plants have never made any distinction whether their carbon dioxide comes from an American, an Arab, a Frenchman, a

German, a Chinese, an Indian, a Russian, or any other source. Similarly, the oxygen we inspire is the produce of all races, creeds, and communities. When a human being dies, the body decomposes into the minerals which plants require to produce food. The food we eat is the product of all races, creeds, and communities. It is the combined effect of all.

In conclusion, we take oxygen without hesitation or discrimination but discriminate and quarrel with other human beings on the basis of race, nationality, color, and religion. Why not take the lesson from plants and generate the feeling of love.

Love of the human race
Love for nature
Love for humanity
Love for spiritual values.

Paper Number 21

Harde, Royal Bruce. "Environmental Studies: Toward A Definition." William Patterson College of New Jersey, Wayne, New Jersey 07470.

Based on a review of the literature, this paper traces the recent history of attempts to define the scope of Environmental Studies as an interdisciplinary field of teaching, research, and community service under the auspices of higher education. Contributing to the acknowledged confusion in terminology is the frequent (but imprecise) interchangeability of Environmental Education, Environmental Studies and Environmental Science. Also contributing is the failure of the standard classification system of degree major programs in higher education, HEGIS (for Higher Education General Information Survey), to provide a proper category for generalized Environmental Studies. A plea is made for the new, replacement system, CIP (for Classification of Instructional Programs), to include such a category. One more contributing factor to the confusion in terminology is the fuzziness of the term 'environment' itself. Since "everything is connected to everything else" (as environmentalists maintain), the object of this field's study is not only fuzzy, it is all-encompassing. Although Environmental Studies must be concerned with the environment of humankind, it must at the same time be concerned with the total environment.

To provide clarification, definitions phrased by early academic programs, significant pieces of legislation, and key reports from important international conferences are highlighted next. Their emphases vary from the subject matter of environmental studies, to the processes of environmental studies, to the guiding principle of environmental studies.

Environmental Studies is then contrasted with seven other distinct fields of study in order to understand exactly what Environmental Studies is and is not. Those overlapping and contributory fields are:

(1) Conservation/Natural Resource Management - (the control

where by humans seek to manipulate natural resources to maximimize the human benefits derived from them and their utilization);

(2) Ecology - (a specialization within the Biological Sciences that deals with ecosystems - all interacting components in the life-support system of a particular habitat and all its species);

(3) Environmental Design - (the attempts of the design professions - architecture, landscape architecture, and urban and regional planning - to plan and design the constituent elements of human settlement more sensitively relative to the natural environment);

(4) Environmental Education - (the methodologies that may be employed by teachers and other interpreters in inculcating a greater awareness, concern, and involvement, among the public vis-a-vis the environment);

(5) Environmental Engineering/Technology - (the techniques of civil and chemical engineering employed on behalf of human sanitation through the design and maintenance of facilities to manage solid waste, wastewater, stormwater, hazardous wastes, radiation and thermal by-products, and gaseous wastes emitted into the atmosphere; as well as the storing and treating of potable water);

(6) Environmental Health - (detection and remediation of the deleterious effects of technological achievements on human health and wellbeing); and

(7) Environmental Science - (the biophysical 'hardware' of environmental studies, in contradistinction to the social sciences and humanities 'software', wherein the applied and basic sciences explore and help solve the problems of the physical environmentas it is impacted by the human environment.)

In order to display the incredible variety of the specialized fields that have emerged as the result of environmental concerns bringing multidisciplinary theories and practices together for the purposes of environmental problem-solving, a table presents 354 subject headings utilized by six indexing agencies to label and distinguish between these diverse fields of environmental specialization.

Having acknowledged the existence and the importance of each of the major fields of environmental study, and most of the major specializations within these fields, the author of the paper offers the following as a tentative, working definition for the broad middle ground of academic environmental concern called Environmental Studies:

> Environmental Studies is the interdisciplinary search for knowledge about, and understanding of, natural (physical and biotic) systems and of the dynamic interactions between these systems and humankind's social and cultural systems.

As such, Environmental Studies is more than a series of instructional- programs for training undergraduate and graduate students. It is also a field of scholarly pursuit, wherein faculty teams examine, sift, resort, and examine again the body of knowledge that will shed greater light on the interrelationships of humanity, its culture and society, and the natural, physical, and biotic environments.

By way of summary, this definition is graphically depicted through a figure illustrating the atomic bonding of a protein molecule, on which is superimposed in a left-hand column the disciplines and professions contributing to Environmental Studies; and in a right-hand column the major specialities emerging from environmental studies.

Drawing on the figure, the paper concludes that, just as the protein molecule would not be what it is plus or minus any one of its constituent atoms, Environmental Studies is no less than the sum and substance of all disciplines and professions that can bring their insights and problem-solving abilities to bear on the interdisciplinary search for knowledge referred to above in the preferred definition. The major environmental specializations that have emerged to date are an effort to apply the insights of one or more disciplines/professions to environmental concerns.

Environmental Studies is not to be restricted to any less than all of the contributing disciplines/professions that are necessary to bring their insights and methodologies to bear on the understanding of, and the solution to, environmental problems. Nor is it to be restricted to any less than all of the emerging environmental specializations aimed at comprehending particular environmental concerns. Each and every potential discipline/profession is needed to contribute to the joint effort that will be realized only when all are figuratively 'present' (literally 'available') in a single place and time applying their individual insights in a way that synergistically yields a result larger than the sum of its parts.

Paper Number 22

Hanie, Robert. "The World of Connections: The 1983 Youth Honors Program." Environmental Studies Program, Sangamon State University, Springfield, Illinois 62708.

Today's high school students will spend over half their lives in the 21st century. We are living in a world of constant change, requiring continual education to enable a person to compete fairly. Some observers speak of our age as a time of scientific revolution equal to that of Descartes and Newton in the 17th century. This "new" physical world is increasingly perceived as a whole system, where everything is related.

The Youth Honors Enrichment Program is entering its fourth year of examining the connections between the world of technology and the world of the humanities. This year the program is divided into two parts: one in which the student chooses a traditional discipline in the morning -- such as astronomy or Shakespearian studies -- and pursues that study intensely, and a second in which the student chooses an interdisciplinary seminar in the afternoon -- such as a sense of place, sense of self, or sense of the future -- in order to examine the relationship between parts and wholes.

Believing that education should be both universal and enriching, the Youth Honors Program is open to all incoming freshmen, sophomores, and juniors of Springfield-Sangamon County high schools, and is college preparatory in nature. The Youth Honors Program encourages a renewed sense of responsibility in its participants. Those who understand that all things are indeed linked should bear a sense of respect for life and the life processes. Finally, it is hoped that students will catch a glimpse of their future roles and will be challenged to devote a larger measure of their energies toward achieving positive goals.

Paper Number 23

Heard, Donald K. "Comprehensive Environmental Education, Design for the Future." Superintendent of Education, Missouri Department of Conservation, Jefferson City, Missouri 65102.

Thomas Jefferson provided the philosophy, common sense, and foundation for American education. Aldo Leopold provided the philosophy, common sense, and foundation for environmental education in America. The challenge for environmental educators for the future is to stimulate the desire of teachers, educators, and citizens for comprehension and ecological relationships and to extend their capacities for informed, independant judgment and ethical action.

Paper Number 24

Hines, Jody M., H.R. Hungerford, and A.N. Tomera. "A Review of Research on Responsible Environmental Behavior: Preliminary Findings." Department of Teaching, University of Northern Iowa, Cedar Falls, Iowa 50613; Department of Curriculum, Instruction, and Media, Southern Illinois University, Carbondale, Illinois 62901.

The charge of environmental educators has become to develop environmentally literate individuals. Such individuals are those who are willing and able to act in a manner consistent with both a substantial quality of life and a substantial quality of the environment. Thus, environmentally literate citizens exhibit those behaviors which reflect concern and respect (e.g., responsibility) for the environment.

A substantial quantity of research has been devoted to responsible environmental behavior. Further, these research efforts have come from a wide array of academic fields, e.g., communication, engineering, psychology, sociology, education, business, forestry. Yet, what this research has to offer those interested in developing responsible environmental behavior in individuals is not immediately obvious. The lack of substantive ties between many of these fields has led to a situation where researchers in what is traditionally referred to as the EE field appear to be unaware of much of the behavior research being carried out in other disciplines. By locating and synthesizing the past decade of empirical research on responsible environmental behavior, it is hoped that information can be gained which will aid environmental educators in both formal and non-formal settings in devising approaches which will successfully lead to the development of environmentally responsible individuals.

To date, 247 studies dealing with varying aspects of pro-environmental behavior have been located through extensive literature searches. Of these, approximately 70 studies have been reviewed thus far and are included in this summary. These studies fall into three major categories: (1) predictors and correlates of responsible environmental behavior, (2) approaches for the development of responsible environmental behavior in formal settings, and (3) assessment of pro-environmental behavior in non-formal settings.

Predictors and Correlates of Responsible Environmental Behavior

Twenty-seven of the seventy studies reviewed thus far dealt specifically with predictors and correlates of responsible environmental behavior. As a whole, these variables fell under the headings of cognitive, affective, personality, and demographic variables.

Overall it was found that general environmental knowledge, such as knowledge of environmental issues and knowledge of causes and consequences of pollution, have been shown to be significant variables in predicting responsible environmental behavior (Borden and Schettino, Geisler and Martinson; Arbuthnot; Iwata; Hummel, Levitt and Loomis). In additon, beliefs also appear to be important cognitive factors in successfully predicting pro-environmental behaviors (Bruvold; Fischer; Czarnecki).

The affective variables of appreciation of natural beauty, emotionality, concern, and attitudes toward the environment have been found by researchers to be significantly related to responsible environmental behaviors (Bruvold; Fischer; Weigel and Weigal; Kronus; Borden and Schettino; Dispota; Iwata).

In the realm of personality variables, level of moral reasoning, locus of control, conservatism, and self-interest all appear to be related to pro-environmental behavior (Trigg; Arbuthnot; Tucker; Dyar; Dispoto; Czarnecki).

A substantial number of studies have been devoted to determining those demographic variables found in association with responsible environmental behavior. These include age, gender, political affiliation, socioeconomic status, and educational level (Arbuthnot; Christenson; Dunlap and Gale; Neiman and Loveridge; Tucker).

While it appears that the research in this area provides sufficient information concerning the important variables in predicting responsible environmental behavior, many important questions remain unanswered. The research does not, for the most part, provide a clear picture of the inter-relationships which might exist between and among the variables related to responsible environmental behavior. In addition, it has not be established which variables are the best predictors of pro-environmental behavior. Such information is vital to the environmental educator interested in devising approaches which will prove successful in developing environmentally responsible individuals.

Approaches for the Development of Responsible Environmental Behavior in Formal Settings

The studies presented in this section are concerned with the development and use of curriculum and instructional strategies designed to encourage individuals to engage in responsible environmental behaviors. Eleven of the seventy studies summarized fall into this category.

Two studies dealt specifically with curricular approaches aimed at altering individual's behaviors in relation to the environment (Asch and Shore; and Ramsey, Hungerford, and Tomera). Both studies employed quasi-experimental designs and attempted to measure student behaviors following exposure to specific EE curricula. In the case of the Asch and Shore study, the curriculum consisted primarily of environmental issues awareness, discussions of ecological consequences of specific human behaviors, and environmentally sound alternatives to such behaviors, values activities, and actual issue investigation. In the Ramsey, et.al., study, there were two experimental groups. Instruction for one group consisted of a case study approach in which students identified environmental problems, learned environmental problem-solving skills, interacted with an environmental problem-solving model, and applied action strategies to real issues. Results of both studies showed that each of the curricular approaches outlined above were successful in increasing the number of pro-environmental behaviors which students were either observed engaging in or which students reported to be engaging in. In addition, the Ramsey, et.al., study revealed that curricula based solely on knowledge of issues was unsuccessful in increasing the number of pro-environmental behaviors engaged in by students. Thus, it appears that knowledge alone is not sufficient to lead to the development of environmentally responsible individuals.

A study by Peyton and Hungerford shows that preservice and inservice teachers are neither competent in designing or in implementing instructional strategies for environmental action. Thus before instructional approaches aimed at developing environmentally responsible individuals can be successfully implemented in schools, appropriate teacher training must be initiated.

The remainder of the studies included in this segment of the synthesis are noteworthy more for what they do not say rather than for what they do say. There are very few EE curricula which have as their stated goals the development of responsible environmental behaviors and which thus direct their efforts at attempting to change behaviors. This lack of emphasis is truly disheartening given the overriding importance of responsible environmental behavior.

Assessment of Environmental Behavior in Non-Formal Settings

Thirty-two of the seventy studies reported here dealt specifically with responsible environmental behavior in non-formal settings (e.g., any setting outside the realm of the traditional classroom). All of these studies employed some type of behavior modification technique in attempting to bring about environmentally responsible behaviors. Specifically, these behavior modification approaches fall into four major categories: (1) verbal and written appeals, (2) incentives, (3) information, and (4) feedback.

The effectiveness of the behavior modification techniques investigated appeared to vary with the type of environmental behavior involved. A number of the major findings are summarized here. Results of the studies reviewed indicate that the most effective way to alter behaviors in non-formal settings appears to be to give the desired behaviors a value. These findings were supported by sixteen separate research studies investigating the effects of incentives on a wide array of pro-environmental behaviors. Verbal/written appeals appear to be relatively ineffective in inducing individuals to engage in pro-environmental behaviors, especially in cases where the required response is relatively inconvenient. Educational programs and informational packages without some special incentive provisions have been quite unsuccessful in motivating relatively inconvenient or time-consuming conservation behaviors. Providing consumers with feedback appears to lead to reductions in energy consumption in cases where the cost of energy relative to income is high. (A complete listing of the references supporting the reported findings may be obtained from the author.)

Concluding Remarks

The original intent of the literature search and subsequent synthesis of findings was to determine those factors indicated by the research as being predictive of responsible environmental behavior. These findings could then be used to provide an empirical base for devising approaches, in both formal and non-formal settings, that would result in individuals engaging in responsible environmental behaviors. Presently these factors appear to fall under the headings of cognitive, affective, personality, skills, and demographic components. Even the incentive variable is essentially dependent upon personality characteristics of individuals. What is not known, however, is how these variable interact with one another nor are the relative strengths of the associations among these variables and responsible environmental behavior known. Without this knowledge, it is unclear whether effective environmental behavior curricula should emphasize knowledge components, affective components, skill components, or some combination of factors. There may be an optimum mixture of affective, cognitive, skill, and personality factors which, when combined in the proper proportion, predispose individuals to behave responsibly toward the environment. Factors not addressed by environmental behavior research may also play a role. It is hoped that additional information may be gained in the process of synthesizing the remainder of the environmental behavior research located thus far which will prove valuable to environmental educators dedicated to the development of an environmentally responsible citizenry.

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*A complete listing of the references cited in this abstract as well as the bibliography containing all 247 environmental behavior references may be obtained by writing to the author.

Paper Number 25.

Hudspeth, Thomas R. "Urban Waterfront Revitalization."
Environmental Program, University of Vermont, Burlington, Vermont 05405.

Within the United States, many of our cities are located on rivers, lakes, bays, and oceans. The cities grew up around their waterfronts. The waterfronts were the center of activity and focal points of these bustling places. Total communities with heterogenous ways of life grew up around waterfronts.

Beginning with the industrial revolution and continuing right up until very recently, however, waterfronts have declined. Changes in the use of urban waterfronts have resulted primarily from four factors: (1) changes in land transportation models, (2) changing economic role of the central city, (3) technological changes in marine trans- portation and cargo handling, and (4) steadily decreasing waterborne passenger travel. Economic and technological forces led to the decline of urban ports as the locus of shipping. Trains and, later, trucks moved goods overland, and the cities began to expand away from the water's edge. Residential areas grew away from the waterfront, leaving water-related industries, shipping, and fishing to take over the waterfront. The waterfront became an area frequented by a small segment of the population divorced from the rest of the community -- the subject of many novels and a Marlon Brando movie -- and cities turned their backs on them. These changes in transportation modes, technology, and economic patterns brought about the decline of waterfronts as the focal points of cities. The waterfronts were neglected, and began to deteriorate.

But in recent decades, the urban waterfront is being given a second chance. After years of neglect, America's coastal and riverfront towns and cities are rediscovering their waterfront areas. In the 1960's, 1970's, and 1980's, tremendous interest has been shown in transforming our naton's waterfronts from desolate, non-productive areas into the active, vital portions of the cities that they were when first established. Such terms as "cinderella syndrome" and "ugly duckling tale" and "transforming a sow's ear into a silk purse with some money in it" have been used to describe this renaissance.

Over thirty percent of the 520 cities in the United States with populations between 25,000 and 50,000 and seventy percent of the 415 cities with populations over 50,000 are located on the edge of a river, lake, bay, or ocean. As many of these cities have sought to improve their images as good places to live, work, play, and visit, they have re-examined their waterfronts, have recognized that they are special and important places, and have undertaken revitalization efforts.

Presently more than fifty cities have completed waterfront revitalization projects, and another fifty have projects planned or under construction. These range from small-scale improvements at the end of a street to linear parks connected with hike-and-bikeways to multipurpose developments combining recreation, housing, and commercial components.

A variety of innovative funding strategies and resourceful and imaginative approaches to urban waterfront revitalization are being tested by many cities. While most of the projects are multipurpose in nature, some are single purpose. Some are initiated by private groups such as downtown business associations, professional organizations, and corporations; others by governmental leaders. They are funded by federal, state, city, and private sources, and usually a combination. Some, such as Boston and San Francisco, involve extensive adaptive reuse of existing structures, while others, such as Baltimore, involve tearing down and clearing away old structures and rebuilding from scratch. Some feature "showcase" redevelopment projects, while others do not.

As a result of these efforts, rotting wharves and piers and pilings, blighted and abandoned buildings, deteriorating warehouses, scrap yards, and vacant lots are being replaced by a mix of structures, uses, and resources.

Why are our urban waterfronts being rediscovered now? Increasing numbers of Americans have traveled abroad, where waterfront amenities are more often the rule than the exception. The treatment of urban waterfronts in many cities in Western Europe has provided us with models for improving our own. Creative approaches by our neighbors to the north in Toronto, Quebec City, Montreal, Vancouver, and Victoria, have also made us more aware of possibilities for our waterfronts. The viewing of the Tall Ships under Operation Sail as part of our Bicentennial celebration in 1976 and again in 1980 by millions of Americans also made us more aware of our urban waterfronts. Designation of 1980 as "Year of the Coast" has focused attention on coastal concerns, including urban waterfronts.

Increased environmental awareness and concern for quality of life over the past two decades account for much of the current interest in urban waterfront revitalization. Several interrelated factors have contributed to these concerns: (1) urban revival, (2) clean-up of waters, (3) urban recreation, (4) coastal zone management, (5) historic preservation, (6) energy concerns, (7) economic development, and (8) conservation of natural resources.

Participation by citizens in the planning process is essential for any wise environmental planning, and urban waterfront revitalization projects are no exception. Citizens for whom waterfront projects are planned must plan an active role if the projects are to enjoy long-term success. Leaders of cities in search of ideas for ways to involve their citizens and find out what they want for their waterfronts can turn to case study accounts of previous waterfront revitalization projects. But empiricalinvestigations of techniques of citizen participation are few. A need exists for research to provide help to these practitioners.

Paper Number 26

Iozzi, Louis A. "Preparing For Tomorrow's World A Workshop." Cook College, Rutgers University, New Brunswick, New Jersey 08903.

Preparing for Tomorrow's World is a futures oriented nationally validated program which was developed by the Institute for Science, Technology, and Social Science Education at Rutgers - The State University of New Jersey. This program is based on the Socio-Scientific Reasoning Model which combines the philosophies, ideas, and research of Institute personnel with the theories of Piaget, Kohlberg, and Selman. This model has served as a guide to help students advance to higher levels of thinking and reasoning capabilities. This "proven effective" program is highly flexible and readily adaptable to other existing programs.

The basic assumption of the model is that effective problem solving for the future requires simultaneous development in the realms of logical reasoning, social role taking, and moral/ethical reasoning. Purely objective scientific thinking cannot be applied in the resolution of most of the probable future conflicts without regard to the impact of those decisions in human needs and human goals. How to best prioritize our needs and evaluate tradeoffs with a concern for the needs of future generations involves logical reasoning and critical thinking, but with an added dimension....a social/moral/ ethical reasoning dimension.

The Institute has identified several of the basic elements needed to provide experiential opportunities that promote development of problem-solving and decision-making skills. These methods and techniques will be described. Participants will, moreover, learn how to incorporate these strategies into their own programs of instruction in environmental education and other curriculum areas.

Hence, the objectives of this workshop are:

- to acquaint participants with the Preparing for Tomorrow's World program and the strategies employed to help their students become more effective problem solvers and decision-makers in an increasingly more complex world.
- to show participants how to adapt (adopt/incorporate) the socio-scientific reasoning model and strategies into their existing program of instruction.

Paper Number 27

Jacquot, Ruth H. "Synergistic Community Programming." Bowling Green State University, Bowling Green, Ohio 43403

The synergistic result of sharing resources, facilities, and staff makes a great deal of sense in these times of cutbacks. There are some problems and roadblocks which can be avoided with some careful planning and understood ground rules. Libraries, school, community education, recreation agencies, and park systems can share in cooperative programs. How does one keep one's identity, who's in charge, and how can one avoid time lags are some of the questions we will deal with. Ruth Jacquot has used this technique for the past five years as manager of naturalist services for Toledo Metroparks and as such has made enough mistakes to qualify her to help others benefit from her problems.

Paper Number 28

Jacquot, Ruth H. "Teachers Teaching Teachers: The Outdoor Awareness Group." Bowling Green State University, Bowling Green, Ohio 43403

"They" are gaining on "Us"....that is, the number of leaders and teachers who are unaware of ecological/environmental concepts and had learned that professional naturalists and outdoor educators are available seem to be growing. This should sound like success, but in a time when staff cut-backs were keeping us from meeting these demands, a group of outdoor professionals (hard to find a term for the conglomeration of environmental educators, naturalists, youth leaders, camp directors, volunteers, and teachers!) saw the need to provide an opportunity to expand their direct contact to one of leadership training. In the past, we had been mildly discouraged by the complaints (valid ones, too!) that we were expecting teachers to do everything. Our presentations at inservice training sessions had been poorly received and even those who attended the sessions continued to ask for our leadership rather than taking that role themselves. Yet, we knew that our product was exciting, fun to learn and teach, and cheap and available in the school-yard or outside the window. The opportunity to provide the encouragement and support was all we needed, we thought. We were right!

The key was finding a few teachers whose interest or childhood experiences led them to the out-of-doors for their recreation and inspiration. These key contacts led to others and soon we had a group which was willing to come to planning sessions and fill the need which we felt existed.

These willing teachers spent a great deal of time hammering out the goals, eating healthy food, and enjoying getting to know each other in a natural setting. The basic goal was "To help children be more aware of their natural surroundings." This may sound too basic, but it was based on the premise that as leaders we had to trust the experience we were offering to children when we shared nature with them - without imposing ourselves on their experience. Ten years of sharing nature with thousands of children had given me faith in this combination of kids and the out-of-doors....with a minimum of controls.

How does one achieve this lofty goal? Specific objectives include:

1. To help teachers and leaders become comfortable in the natural environment.
2. To encourage the training of environmental leaders in our area.
3. To increse community awareness of environmental education.
4. To encourage sharing and cooperation between professionals in the broad field of outdoor education.

Workshops and publications were planned, keeping these goals in mind. Goal number 1 gave us the idea that each workshop should start with a personal experience in the natural area for each participant. Enforced solitude was a bold step. "Go sit under a tree," was the usual order for the first session. They did it....with simple "situpons" made out of newspaper and garbage bags. On workshop evaluations, the solitary time rated high and continues to on each successive workshop.

This is not a personal triumph for any of the initiators, but a success story that continues to justify our enormous faith in the teachers and leaders who showed a desire to learn more about the out-of-doors. Collegial inservice training is nothing new, but a growing network of teachers teaching other teachers and sharing their expertise in each other's classrooms is very gratifying. We continue to grow.

Cooperative community efforts in any field are becoming attractive approaches in this era of cutbacks and belt-tightening. As environmental educators, we should take a leadership role in cooperating with other agencies to make the most of our resources. The most exciting aspect of this cooperation is its synergistic effect. Imagine turning down the opportunity to expand your plant resources, your graphics capability, your clientele, your research resources, your secretarial staff, your horizons, and much more for the cost of some time, energy, and planning! There are few communities where this is not possible. The excitement grows as you realize the opportunities for your own personal and professional growth. One of your greatest surprises as you search out cooperative people may be that they were waiting for someone else to make the first move.

"Networking" does not adequately describe this process, since it has the potential for being one-dimensional or linear. Synergism is multi-dimensional and logrithmic in its results.

We qualify as tour guides on this trip through new territory since we have made many of the mistakes we hope to identify for you. There are some barriers and detour signs are disguised to lure you along dead-end streets. Included is Figure 1 as an example of some planning done by three agencies when they produced a series of successful programs. You may want to use it like a road map. Some other guidelines are:

1. Know your agency. More than a basic understanding or your own organization is essential since adaptations and innovation are in order and approval or at least a willingness to look the other way is necessary. So the first law is "know thyself."

2. Know your community. Write a list of all the agencies you know of in your community whose goals overlap or interface yours. Then check a community listing and find ones you didn't think of. Begin establishing a climate of cooperation with people/agencies you already know and aggressively and persistently include others from your list. Does your wider circle now have the capability of community-wide celebration? Are there specific issues which need a forum? Should an on-going program or publication be produced? Is there any limit?

3. Be adaptable. Establishing and maintaining a climate of trust gives one the opportunity to be adaptable and make the most of all opportunities as they arise. It is impossible to be creative and cooperative in an arena of suspicion and paranoia. There need not be competition for members or recognition, since we are talking about innovation, not repetition, plagerism, or proselytizing.

4. Be willing to meet and talk often. Keeping your finger on the pulse of any activity helps head off any disasters such as a misspelling of your agency name or an incomplete list of cooperating agencies. It is wise to review all publicity before it gets to the printer and find out how willing your agency is to become a part of the melting pot. New techniques for thorough communication may develop.

5. Try it! Try it again! Good luck!

Paper Number 29

Jain, S.C. "Future of Technological Culture." School of Science, Oyo State College of Education, Ila-Orangun, Nigeria.

Technological developments are the products of human thinking and have benefited us by providing improved systems of transportation, communication, medicine, agriculture, power generation, and defense, and have established a "technological culture." This new culture has shaken human relationships to the

Figure 1.

	Metroparks	Public Library	Community Service Organization (Suburban)
Agency Philosophy/ Goals	"to preserve the natural environment for the benefit of present and future generations."	To provide free access to audio, visual and printed resources on a wide range of topics from leisure to business and industry To stimulate the use of these materials	To meet the cultural, recreational, educational and social service needs of the community through existing services and creating programs where a need exists.
Personal goals within agency	To encourage and interest the public in using the parks in non-consumptive and appropriate ways.	To promote the use and enjoyment of Art/Music/ Sports/Leisure Activities collection	To implement and market programs to enhance the purpose
Funding Source	Property tax - Renewable Local Government Funds Gifts and Bequests	- Intangibles tax (100%) on stocks, bonds - Property tax (renewed 1982 for 5 years)	Funded by local government and supported by community education programs
Population Served	Northwest Ohio Residents - Principally Lucas County	- Lucas County Residents - Non-county residents working in the county	The suburban community and the greater metropolitan area adjacent to the suburb
Limitations	- Purpose of preservation limits some activities - Night closing of parks Small staff Constraints of tax supported agency -	Programs, like most other library services should be free or of nominal cost. Charges should only cover special materials, not labor nor should they create a profit.	Programs need to be financially supportive- after school hours for programming only. Implementation
Types of Program Implementation	Nature Walks Media programs - Workshops Publications	Programming, reference work, booklists, exhibitions, etc.	Community education classes for children, adults and senior citizens. Community publication including other agencies' program information
Resources	Printing Press, Public Information System, land, many buildings, lodge, vehicles, office staff, naturalist staff - Some printed resources, 50 volunteers, 8,000 address mailing list	Meeting room space countywide 17 branches in neighborhood locations Silkscreen printing capability Compugraphic for fast typesetting Display staff 108 Professional and semi-professional staff	Class rooms, educational personnel, typing services, 26,000 circulation of newspaper, referral capacity, registration services

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point of breakdown. Technologically developing societies are oscillating between the traditional view-points and modern alternatives. The present form of valueless "technological culture" is helping in the exploitation of man by man, fostering inhumane attitudes, and producing chaos and insecurity. The crisis in human character is due to the deterioration of values in social, economic, and religious life. The main factors responsible for international strife and discord are mutual distrust, envy, jealousy, fear, hatred, and lust for power enhanced by the technological culture. Technology has given external power and damaged the values of life, love, and brotherhood. Due to poorly directed technological developments, we have become independent, over-confident, and full of pride rather than cooperative.

If we want a more fulfilling life, we have to accept a balancing formula. That is, a balance between basic human values (including social and religious ones) and technological developments. The values can be inculcated to a great extent by preserving our traditional, religious, and cultural heritage. Technology should serve mankind rather than visa versa. The enlarged sense of human identity can increase our potential as human beings and help us to become more fully human.

Paper Number 30
Jain, S.C. "Technological Developments and the Ecology of Developing Countries." School of Science, Oyo State College of Education, Ila-Orangun, Nigeria.

Technological developments have created many luxuries such as improved systems of transportation, communication, medicine, agriculture, and industrialization. This charm has gripped most of the developing countries. They are busy in importing technology and establishing heavy industries without proper ecological considerations. It has led to ecological disturbances in the regions including pollution and new diseases. The rapid technological and industrial growth has also disrupted the societies of many developing countries.

Paper Number 31
Kiseda, John. "Acclimatization - Interest Session." Mahn-Go-Tah-See Outdoor Education Center, Hale, Michigan 48739

Acclimatization programs help people of all ages build a sense of relationship - through both feelings and understandings - with the natural world. In this interest session, basic Acclimatization philosophy will be explained along with a slide show on the 5th-6th grade resident environmental program "Sunship Earth." An outside acclimatization walk or a concept building activity will be followed by a question and answer session allowing the participants time to ask specifics to their own program needs.

Paper Number 32

Kumer, Kamlesh. "Ecological Imbalance in Garhwal Himalaya." Botany Dept., Government Post Graduate College, Gopeshwar, Chamoli (UP), India.

The Himalayas, the youngest, but the loftiest mountains with their peaks piercing the sky, are one of the most important botanical regions of the world. They have a large proportion of endemic species native of the region. The majestic Himalayas are attractive to life-artists, writers, poets, and scientists, and provide unique opportunities for hikers, trekkers, mountaineers, skiers, and naturalists. In addition, the Himalayas are the weather makers of Asia. In many ways, the Himalayas have influenced the life, culture, and history of this subcontinent. The Garhwal Himalaya Mountains lie between the latitude 29° 26' - 30° 28' N and longitude 77° 49' - 30° 6' E with a total area of 30,000 Sq. Kms. The whole of the Himalayan region of Garhwal, which is also known as "The Land of Lord Shiva and Vishnu" "Deva-Bhumi" is unique for its flora and fauna. Several development projects are currently underway in the region, whose merits are obvious but adverse ecologial impacts are not readily visible or foreseen. The result is a man-made disaster resulting from injudicious interference with the fragile ecosystem of the region. This paper summarizes the development project, their environmental impacts, and the overall environmental degradation in the Garhwal Himalaya region.

Paper Number 33

Leach, Susan S. "Games for Teaching Great Lakes Ecology." President of the Consortium of Aquatic and Marine Educators of Ohio, Columbus, Ohio 43220.

This session presents two oceanic education activities for Great Lakes schools: "To Harvest a Walleye" and "Yellow Perch in Lake Erie." Concepts are taught through the use of board games and role-playing situations and include introducing basic ecological relationships in a lake community, the stages in the life history of a freshwater fish and the population density at each stage, as well as management of a fish species in Lake Erie.

Paper Number 34

Mayer, Victor J. "The Importance of the Great Lakes in Education." College of Education, The Ohio State University, Columbus, Ohio 43210.

What do you know about the Great Lakes? You probably know that there are five, six if you include Lake St. Claire. I'm sure that you know their names. You may even know that they comprise the largest single body of fresh water in the world. And that if their waters would be spread uniformly over the United States it would form a lake 9 feet deep. But, did you know that a naval battle between Confederate and Union forces almost took place in Sandusky Bay in 1864? That the objective of the Confederate contingent was to take over the first American iron clad warship, the U.S.S. Wolverine, free the Confederates held prisoner on Johnson's Island (a Union prisoner of war camp), and with them and the ship bring the Civil War to the Northeast? Did you know that the Port of Toledo is a major international port with over 800 vessels of foreign registry passing through the port in a given year? And that Toledo is just one of 22 deep water ports on the Great Lakes? Did you know that according to a recent study, Lake Erie has a $675 million economic impact upon the northern 17 counties of Ohio?

You may know some of these facts, but the children in Ohio's schools do not. A study conducted by Dr. Rosanne W. Fortner in 1979 (Fortner and Mayer, 1983) found low levels of knowledge regarding the Great Lakes and marine environments. For example, ninth graders scored an average of 48 percent on a multiple item instrument assessing their knowledge of these environments. Fifth graders scored lower, 38 percent. In fact, Ohio's children seem to know less about the Great Lakes than they do about the oceans. It was surprising to find out, for example, that only 44 percent of fifth graders and 60 percent of the ninth graders know that Lake Erie forms a portion of Ohio's northern border. On a question about Perry's victory on Lake Erie, only 18 percent of the fifth graders and 39 percent of the ninth graders knew that the famous message "We have met the enemy and they are ours..." was said by Perry following the battle.

It's little wonder that Ohio's children know so little about the lakes. When asked if they studied the oceans or the lakes in school, 16 percent of the fifth graders and 26 percent of the ninth graders said "not at all" and another 48 percent of the fifth graders and 53 percent of the ninth graders said "a little." So it appears from the point of view of the students that Ohio teachers devote little or no time to the oceans and the Great Lakes in their instruction.

This is unfortunate, for two reasons. First it is essential that our children understand our local environments. In this case their local Great Lake. When they become adults they will be faced with political, social, and personal decisions that will affect those environments. Unless they have knowledge of the lakes and their tributaries, those decisions will be uninformed. The other reason for studying the Great Lakes is to localize concepts learned in schools making learning more effective. Children find it easier to understand general ideas and concepts if they are given examples that they are familiar with or could experience. Such examples also enhance their interest in the subject being taught, therefore assisting effective learning of concepts.

The history of the east and midwest is closely intertwined with that of the Great Lakes giving teachers excellent opportunities to draw from that history for the localization of historical concepts. For example, with the opening of the Erie Canal through New York state, the Great Lakes waterways became the major avenue for the shipment of grain east, and the movement of migrants west. The following anecdote illustrates both:

In 1849 Daniel Muir, with daughter Sarah and 11-year old son John, left his native Scotland, for Canada. It took six weeks to cross the Atlantic to New York. They traveled up the Hudson River and down the Erie Canal. Along the way Daniel heard of the harshness of the Canadian environment; in some respects it was similar to the difficult Scottish environment he had just left. He also heard of the fertile fields of Michigan and Wisconsin. But he remained resolute in his determination to settle in Canada.

When they arrived at the terminus of the Erie Canal in Buffalo, Daniel saw ship after ship bringing grain from the fields of Wisconsin. He never in his wildest dreams had imagined such abundance. Then and there he decided to go to Wisconsin.

The lake streamer carrying the Muirs sailed past the fields of Ohio along the shores of Lake Erie, and those of Michigan along Lake Huron. The streamer then sailed down and across Lake Michigan to the Port of Milwaukee. There Daniel hired a wagon and horses to take them some 100 miles onto the central plains of Wisconsin where the family settled.

Young John would lay awake at night listening to the chorus of wolves howling from the ridge tops. During the day as he followed the plow or cultivator he would observe the living things around him and the beauty of the Wisconsin scenery, absorbing the values that would make him the greatest naturalist and conservationist who would lay the foundations of our National Park System.

As important as the Great Lakes have been in our history, they are essential to a healthy economy for those states bordering them. A recently completed study by Ohio Sea Grant, for example, found that Lake Erie had a $675 million impact in 1978 on the 17 northernmost counties of Ohio. This impact was the result of only six sectors of the economy: commercial fishing, charter fishing, water transportation, mineral extraction, marina and boat dealers, and other Lake Erie related recreational activities. Not included was the lake's economic role in providing water for industrial and domestic consumption, nor its role in energy production. Niagara Falls, for example, with the 13 units of the Moses Plant, provides a generating capacity of 2,000,000 kw of electricity for New York state; nearly 10 percent of its total capacity.

There are threats to this economic base for our states. Most of the economic sectors evaluated in the Ohio study required adequate water quality for their support. The careless disposal of sewage, hazardous waste, and certain agricultural practices can undermine water quality as they did prior to the decade of the 70's. We recall the desperate shape that the Cuyahoga River was in, and the degraded quality of Lake Erie water, water that would not support important game fish. The walleye fishing industry now accounts for $250 million of the economic impact of Lake Erie in northern Ohio. With the change of attitudes in Washington toward environmental policy we could return to the situation prior to the 70's when walleye could not live in the lake.

This is one reason why our children must know more about the lakes. So that they as adults can take informed action to secure the best uses of the lake environments.

The major reasons our children don't study more about the Great Lakes in school relate to the national nature of the curriculum materials used and to a failure in teacher training. Our curriculum materials are developed by a few publishers for a national market. Because of the profit structure and competition in the industry, these materials must be acceptable to the broadest possible constituency. Therefore examples of local interest and value must be replaced by a few of national importance. The teacher training deficiencies are largely a result of the failure of area colleges and universities to offer courses in the academic disciplines dealing largely with Great Lakes information. In a recent survey of marine and aquatic courses offered by Ohio institutions of higher education (White-Predieri, Mayer, and Leist, 1981), no courses were found at the undergraduate level that dealt primarily with Great Lakes topics. How can we expect our teachers to teach information they have not had the opportunity of learning?

There are a few bright spots brought primarily by the sea grant organizations of the various Great Lakes states. Ohio, for example, has completed a cycle of curriculum development in which 23 modules were written to be infused into existing curricula. This effort was followed by three years of dissemination involving workshops offered all over the state. Michigan Sea Grant has also developed teaching materials dealing with the history of the fishing industry in that state.

Somehow, the message needs to be brought to the schools that the Great Lakes must be studied by our children in all content areas. Our children must be brought to understand that we cannot afford another dead Lake Erie. They must know more and value more.

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Paper Number 35

Medina, Agusto Q. "Children and Environmental Educators: Differing Views of the Urban Environment." Michigan Sea Grant College Program, Ann Arbor, Michigan 48104.

My interest in children and the urban environment goes back to my scoutmaster days in Greenwich Village. At that time I was also conducting an outdoor education program for a community center on New York's west side. In both cases I took children out of the urban environment and into the "natural" environment. While the children seem to enjoy such trips, I was puzzled by what it meant for them and how it related to their urban experience. I questioned whether my perception of the environment had meaning for the kids I worked with.

I found little in the environmental education literature that related to my concerns. Environmental educators have placed little emphasis on understanding the child's world. They seem to have assumed that their own cognitions of environment are similar to children's, or that they can surmise children's perceptions of the world. The validity of these assumptions is, however, questionable. One study revealed that even adults with special training on the urban child were unable to approximate children's perceptions. Strong evidence also indicates that experts view the world differently than do non-experts, and that children and adults view the world differently. Because of children's special perspective (small size, fewer preconceived ideas), and because environmental educators are both adults and experts, cognitions of the environment between these two groups are likely to be dramatically different.

My study sought to identify and examine children's perceptions of their environment. In addition, I wanted to compare children's perceptions of the urban environment with environmental educators' perceptions of the same environments. Such information would be useful in the development of environmental education materials and programs.

Two constructs seemed particularly useful in identifying and understanding children's perceptions. The first was preference. People's preferences about environment are neither random nor idiosyncratic. And although they are subjective, the subjectivity is shared to a remarkable degree. Important differences between experts' and other people's perception of the environment have been demonstrated through the use of preference ratings. Preference is also a judgment which people can easily make.

The second construct is familiarity. Its effect on preference has been shown to be quite intricate. In some cases greater familiarity increases preference, in others it does not.

To assess children's and environmental educators' environmental preferences and familiarity I developed a photoquestionnaire. This questionnaire contained 56 scenes of the urban environment. The subjects depicted included housing, commercial districts, open space/recreation, and transportation. Under each scene two Likert-type scales were printed:

> How much would you like your neighborhood to look like the kind of place shown in the photograph?

For familiarity the question was:

> How familir are you with the kind of place shown in the picture?

Participants rated each scene in response to these two questions by circling a number on the Likert scale. A one meant, "not at all," and a five meant, "lots."

The sample included 207 middle-school students from Detroit, Michigan, and 92 enviromental educators from throughout the United States.

A nonmetric, factor analytic method was applied to the students' preference ratings. This yielded 8 patterns or families of pictures that characterize important categories within the urban environment. Each pattern was named according to the dominant theme they represented. Three patterns were housing-related (Multiple-family Housing, Single-family Row, Tree-lined streets) and five dealt with other aspects of the urban environment (Urban Mobility, Urban Parks, Retail City, Industrial/Factory Sites, Run-down Urban). These patterns, rather than the individual scenes, served as the basis for further analyses of participants' familiarity and preference ratings.

First I will discuss familiarity and then preference. I will follow this with an analysis of their relationship to each other.

Students' and environmental educators' familiarity ratings differed strikingly from each other. The students rated all the patterns as significantly less familiar than did the environmental educators. Except for two patterns (Tree-lined Streets and Retail City), students and environmental educators tended to be familiar with the same kind of urban places. Students, however, had less experience than did the environmental educators with such places.

Major differences existed between students' and environmental educators' preferences for the patterns. The two groups agreed only on what they did not like. Both rated Industrial/Factory Sites and Run-down Urban as their least preferred patterns.

What the two groups liked about the urban environment bore little resemblance to each other. Students' most prefereed patterns (Single-family Row Housing and Urban Mobility) were much more "urban." These patterns were characterized by high housing density, unobstructed open spaces, few trees, and opportunities for travel and activity.

Environmental educators' most preferred patterns (Tree-lined Streets and Urban Parks) were more "natural." These patterns were characterized by low housing density, lots of trees, and small open spaces.

The relationship between familiarity and preference is intriguing. For environmental educators a line can be drawn which connects seven of the patterns from low to high familiarity/preference. Only Urban Mobility does not fit this line.

For students the relationship is more complex. Their patterns fall along two major axes from low to high familiarity/preference. One line connects Industrial/Factory Sites, Retail City, Urban Parks, and Urban Mobility. A second line, shifted towards higher preference, connects the three housing-related patterns (Tree-lined Streets, Multiple-family Housing, and Single-family Housing). The only pattern which does not fit either line is Run-down Urban.

These results suggest that the more familiar a pattern is, the more preferred it is likely to be. This relationship is especially strong for environmental educators. For students the relationship is less clear. They seem to divide the urban environment into two parts. One part is the home environment, the second is "everything else." When one considers the importance of the home environment to children, it seems reasonable that they rated the housing patterns as more preferred than the other patterns of the urban environment with similar levels of familiarity. This is not to suggest that the home environment is any less important to environmntal educators. But rather, as one grows older, other parts of the environment increase in significance.

The positive and linear familiarity/preference relationship just described does not, however, always hold. Where opportunities for involvement are low, preference does not increase regardless of how familiar participants were with the pattern. Witness the Urban Mobility pattern for environmental educators and the Run-down Urban pattern for students.

The results of this study clearly indicate the importance of the home environment in children's lives. These are the places children know and care about. As such, the home environment is a place where environmental educators could effectively connect with the child's world. This is also true of environments high in involvement.

The data suggests that the more familiar children are with an environment, the more it will be preferred. This is a strong argument for continuing to expose children to the "natural" environment. This may seem contradictory to my earlier statement emphasizing the use of the immediate environment in environmental education programs for children. It is not, however, a question of one or the other; both are necessary. Both must be linked if an understanding of the total environment is to be achieved. However, because of the importance of the immediate environment in children's lives, it is an excellent point from which to begin exploring the world in which they live.

Since environmental educators and children exhibit such divergent perceptions of the environment, it makes sense that environmental educators take the time to determine children's environmental perceptions. Otherwise, we will be attempting to impose our own limited values about environment. In doing so, we will fail to address children's environmental concerns or to touch the reality of their experience.

Sophisticated methods such as the ones used in this study are not required to determine children's environmental perceptions. Much can be learned by listening to what children say, observing what they do, and asking thoughtful questions.

Paper Number 36

Mills, Ted. "A Study of the Relationship Between Information and Attitude for Users and Non-Users of Computerized Water Resource Management Simulation." Director, Natural Resource and Environmental Education Center, Oklahoma State University, Stillwater, Oklahoma 74078.

A U.S. Water Resources Council Study of U.S. water supplies identified water resources as the nation's most serious long range problem (Sheets, 1981). Numerous articles in the popular press and TV specials reflect high public interest as well as indicate the magnitude of water resource problems. Public interest in environmental issues has been shown to represent a major and enduring social concern, however public knowledge of issues is distressingly low (Council on Environmental Quality, 1980).

A number of professional organizations are addressing the problem of how, when, what, and whom to teach about water. One of the objectives of the Water Resources Education Project (House, 1982) is the application of computer technology to the complex problem of water resource education.

Computerized instructional format includes: (a) drill and practice, (b) tutorial, and (c) simulation (Electronic Learning, 1982). Simulation has the potential for creating intervention with functioning models of real phenomena. McLean (1973) defines simulation as an "operating model of the real world made up of selected sets of interrelationships that reduce complex problems to manageable size for instructional purposes." The use of computer simulation for complex environmental problems has great potential. It is uniquely suited to environmental education because it can: (a) speed up or slow down time, (b) employ expensive or unavailable materials and procedures, (c) act to objectively select random phenomena, (d) provide active participation and input by the learner, (e) provide immediate feedback, (f) reduce complex problems to manageable size, (g) create problem situations where processes and concepts from many disciplines are interrelated in the search for solutions, and (h) allow exploration of alternatives without having to live with harmful consequences (Noonan, 1981; Blosser, 1982).

A current drawback of computer simulation is that participation is limited to one or a few persons at any one time. A critical ingredient of environmental education is missing. Group interaction in clarifying problems, considering alternatives and trade-offs, decision-making, and cooperative action so necessary in environmental problem solving is slighted. A multi-user interactive computer simulation (MICS) solves this problem by providing input from a number of participants at one time, summarizing interactions and sharing results simultaneously with all participants. In addition to simultaneous group interaction, a MICS models situations where relevant environmental concepts and issues are considered objectively in the absence of excessive emotional bias common to local site-specific water issues. Emotional involvement is present but not to the degree it interferes with consideration of rational alternatives!

The Water Resources Management Simulator (WRMS), a multi-user interactive computer, is designed to improve understanding of the major factors involved in intelligent management of water resources. The WRMS offers a visual model of hydrologic information and provides up to 30 participants the opportunity to develop and evaluate water management strategies. The WRMS models four problem areas common to river basins: (a) source and quantity, (b) use of water, (c) quality, and (d) political management of the water resource. The WRMS operator can choose to model any one of nine different river basins.

A large simulator panel placed in view of the audience is programmed to display snow pack and instream flow based on actual USGS data for the basin being modeled. Instream flow, and water quality (silt and dissolved solids) are monitored by visual up and downstream LED (Light Emitting Diode) displays. Flashing lights indicate serious low water or flood conditions. The Sub Basin Storage and Demand displays show current ground and surface water reserves, and the relative demand by users. Horizontal LED's indicate the proportion of ground or surface water used and the proportion of water consumed or returned to the stream. A clock in the upper right hand corner displays accelerated time in months and years.

The simulator is operated by participants using several small control consoles. Water management decisions regarding impoundment, demand, surface or ground source, technology applied to water use, and treatment of used water are made with controls on the consoles. Consoles allow participant input to the large display panel in four water use categories: (a) irrigation, (b) livestock, (c) municipal and industrial, and (d) energy. A fifth console provides for the creation and management of a reservoir. The hydrologic situation and user input is summarized and displayed on the main panel providing the audience with the consequences of various user management practices. As the simulation operates, important data such as monthly instream flow, ground and surface water reserves and total demand are presented as a video color graphics display. In addition this data is stored in memory and can be retrieved for manual graph plotting.

The participants in a simulation may interact with the river basin model at any time, changing variables to optimize their situation. Supply/demand, pollution, applied technology, or other issues may be discussed, new management strategies planned and another simulation initiated to test these newly developed strategies. A major attribute of the WRMS is its ability to place groups of people in policy-making situations involving real variables and alternatives and to present within reasonable time the probable consequences of their various water management strategies.

The development of educational computer simulation is in its infancy and although the number of available simulations is rapidly increasing the analysis of computer simulation experiences and related research base is not extensive (Moursond, 1981).

Objective

The intent of this study was to create base line data concerning the educational potential of an interactive computer simulation to influence water related knowledge and attitudes. Specifically the study was to identify differences in knowledge and attitudes between 13- to 18-year old subjects and adults.

Method

A WRMS knowledge test (Copies of the WRMS knowledge test are available from the author upon request) was developed directly from the stated objectives for the simulator following critique of the objectives by over 60 science educators and water specialists. In addition, test items were reviewed by two environmental science specialists and the content validity found to be satisfactory. The Kronbach Alpha reliability coefficent for the final 25 knowledge questions was .87. Twenty-five was the highest possible score.

Attitude toward water resources was determined by administering a 5 item Water Concerns Scale (Watkins, 1974). Likert-type statements were weighted on a scale of 1 to 5, with 5 indicating a greater concern. Responses totaling 25 indicated the highest possible level of water concern.

The population studied included 866 subjects ranging in age from 13 years to adult. Thirteen to eighteen-year-old subjects were given WRMS treatment as part of their junior or senior high school classes. Approximately 50 percent of the students at a partgicular grade in each school system were assigned to the WRMS treatment groups and 50 percent to the control group. Adult subjects were members of civic groups, public school teachers, and other professionals.

Each of the one and one-half hour WRMS training sessions was presented by a trained coordinator following a specfic outline. All sessions used the same introductory slide presentation.

Summary of Results

A. 13- to 15-year-old WRMS users showed:
(1) higher levels of water resource management knowledge and (2) higher levels of concern for water issues. For the total population of 14- and 15-year-old subjects a significant positive correlation existed between knowledge and attitude scores.

B. 16- to 18-year-old WRMS users showed:
(1) Significantly higher levels of water resource management knowledge, and (2) significantly higher levels of concern toward water issues. For all adult subjects a slight negative correlation existed between knowledge and attitude scores at a 0.09 level of significance.

C. Adult WRMS users had a (1) significantly higher knowledge score, and (2) a slightly higher level of concern for water issues. For all adult subjects a slight negative correlation existed between knowledge and attitude scores at a 0.09 level of significance.

D. Adult mean knowledge and attitude scores were significantly higher than those of the total 13- to 18-year-old population, however, there was a trend for older students using the WRMS to approach adult attitude levels.

Discussion

The WRMS is an effective (a) water information dissemination tool, particularly at the senior high school and adult levels, and (b) a method of increasing concern for water issues particularly with 16- to 18-year-old high school students. Correlation between knowledge and attitude scores was generally positive for all students and negative for all adults. The ability of WRMS treatment to significantly increase adult knowledge, the initial high adult attitude scores and negative correlation between adult knowledge and attitude suggest that the WRMS may moderate extremely high levels of adult concern for water issues. This suggestion is supported by Ramsey and Rickson's study (1976) of high school students' environmental knowledge and attitude. They found that high knowledge levels are related to moderate, as opposed to extreme, stands on pollution abatement. The potential of interactions with the WRMS being a moderator of extreme bias needs to be explored.

The application of the Water Resource Management Simulator as a public education tool has great potential. The simulator's ability to increase knowledge and concern for water issues prior to actual confrontation with water issues makes it a valuable asset in the public education arena. School districts, state and federal agencies, as well as universities should consider dissemination of programs to make the WRMS available to a large segment of the general population.

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Paper Number 37

Monroe, Martha C. and Carolyn J. Tzitz. "Bridging the Gap Between the Natural and the Built Environments With Nature Center Programs." Program Director, Dahlem Environmental Education Center, Jackson, Michigan 49201; General Managers, Vasona Discovery Center, Los Gatos, California 95030.

Across the country nature centers play a vital role in protecting and interpreting the natural world to thousands of visitors. Through excursions to frog ponds, climax forests, or intriguing canyons, many people experience their outdoor environment and come to appreciate the complex world of nature. These ventures to nature centers help people understand the ecological principles that govern life on our planet. But, to understand principles such as food webs and the water cycle only as they function in the natural world is not enough. Naturalists and nature centers need to bridge the gap from the natural environment to the built environment. This can be accomplished with a few mofifications in their existing programs.

Recent trends in movement patterns, population growth patterns, and lifestyles in the U.S. are creating problems in the environment. Almost 75 percent or our population is crowded onto 16 percent of our land surface (Ann Arbor News, 1981). With a large segment of population centralized in urban and suburban areas, many people may not be able to visit a natural area. Without contact with the natural environment, many may not be aware of ecological principles functioning in the environment, nor the importance of these principles to their lives.

Life in the city has made it difficult to see people's role in the interrelationships of natural systems. Though one individual may not see the impact of his or her actions, a large group of people concentrated in a restricted area (such as a city) can have devastating and far-reaching effects on the land and its resources. To supply a city's energy needs, tons of coal may be mined a thousand miles away, then shipped to its power plants. Not only will the area where the coal was mined be affected by this urban demand for power, but lakes hundreds of miles away may be effected by acid rain pollution resulting from the emissions of burning coal.

The potential for educating urban dwellers about the natural environment and its interactions with the urban environment lies in existing nature centers. Through their programs, the centers already teach visitors about the natural world. With a few modifications, interrelationships between these environments can be illustrated. Thus, visitors may see how their lives are related to the natural environment.

By modifying activities, the concepts learned at the nature center could be transferred back to the urban environment. These transferring concepts are relevant at the interpretive site and in the students' home environment (Milmine, 1971). Such concepts show interconnections, build principles, and broaden the learning experiences.

To organize appropriate transfer concepts into a manageable form, an outline of major components was created encompassing various systems that operate within both environments. These include energy, water, food, shelter, wastes, and transportation. Within each of these components, four general understandings outline the relationships between the urban and natural environments. These concepts (see Table 1) can be used at nature centers to modify their programs to help visitors make the connections between the two systems.

Table 1. Major components and General Understandings

Energy

1. The sun is the ultimate source of all energy on earth. Energy cannot be created or destroyed, but it can be changed and stored in various forms (i.e., green plants, seeds, fruit, vegetables, coal, oil, etc.).
2. The sun's energy is captured by green plants, which then make it available to other organisms that cannot directly convert the sun's energy for their own use.
3. Energy from the sun is transferred through the trophic levels, from producers to primary consumers to secondary consumers to tertiary consumers, through an ecological pyramid, losing efficiency as energy moves up the pyramid.
4. People not only use the energy available in the pyramid, but also harness other energy sources, such as water, wind, sun, fossil fuels and nuclear fission for producing goods and services, transporting people and products, heating and lighting homes, producing and processing food, but we are moving toward cleaner, renewable sources such as sun and wind energy.

Water

1. An adequate supply of clean water is needed for all living things; all organisms are composed of mostly water which is needed to carry on their life functions.
2. Water is a finite resource that is recycled in various forms throughout the environment, both the built and natural components.
3. Water is the home for many small plants and animals, which act as food sources for larger land and water animals. Through photosynthesis, these plants produce oxygen for all living things in the system.
4. City water sources depend on the same water cycle; with so many people using water for diverse functions, such as drinking, waste disposal, recreation, irrigation, manufacturing, processing, etc., there are many impacts on the built and natural environments, which in turn affect people.

Food

1. Food provides all living things with energy, (which ultimately comes from the sun), which allows them to stay alive and well and reproduce.
2. Adequate food supplies must be available throughout the year, and must be in forms that organisms can digest to obtain nutrients and energy.
3. Animals in the natural environment must meet their nutritional needs through local food sources, often storing food for times when sources will be scarce or nonexistant.
4. People can buy almost any food at any time of the year, and are not always dependent on local supplies alone. But, people are still dependent on natural resources - soil, water, nutrients, sunlight - to produce their food.

Shelter

1. Organisms use shelter to maintain a near-homogeneous environ-

Table 1 (continued)

ment around themselves, protecting themselves from adverse elements - rain, wind, snow, predators, etc.

2. Shelter is located near resources that will meet the needs of residents of that shelter.
3. In nature, shelters are constructed with local materials easily obtained and readily available, and in a shape and location that will suit the residents' needs.
4. People often build shelters to suit their wants, which do not necessarily best utilize local resources, nor are best suited to local conditions. All people needing shelter are not able to meet their needs.

Wastes

1. Wastes are leftover materials that an organism can not utilize.
2. Wastes are broken down by a group of organisms known as detritivores; these organisms consume these wastes for energy, breaking down materials to an elemental state, and prepare them for reuse (recycling) by other organisms.
3. This breakdown process takes time. If an area is overpopulated, more wastes may be produced than the detritivores can handle, resulting in a build-up of wastes.
4. People are throwing away more wastes than the detritivores can handle, resulting in a build-up. Many of the items thrown away could be reused or reprocessed. Some wastes produced by people are toxic or hazardous, cannot always be broken down by detritivores, and may even poison the environment.

Transportation

1. Organisms move in the environment from place to place by various means (walking, running, flying, crawling, etc.) in order to find resources needed for survival (water, food, shelter, etc.).
2. Organisms usually follow regular, well-travelled paths; these paths connect various resource centers so that organisms can travel the quickest and safest routes to fulfill their resource needs.
3. In nature, animals follow trails that they create, leading to water, food, shelter, and safety.
4. People build transportation routes (car, bus, bicycle, rail, etc.) to connect various places for food, work and supplies, recreational areas, and other cities. Some means of transportation are not as efficient as others, resulting in a waste of resources.

The Dahlem Environmental Education Center of Jackson, Michigan developed a series of school field trips programs with this goal in mind. With assistance from the Institute of Museum Services of the U.S. Department of Education, fourteen environmental education programs from preschool to fifth grade were developed. Each program helps make the environment relevant to the students by addressing human impact in the natural world and ecological principles at work in urban environments. The latter is accomplished primarily through teacher packets of pre-trip and post-trip activity ideas and information. Both the teacher packets and field trip outlines are available for a small fee to interested educators and organizations.

Before the development process began, several constraints to ideal program use were identified: 1) field trips can only last 1-3 hours, 2) few teachers build upon the field trip concepts in school, and 3) administrators favor repeat trips to a center only if they know the students are learning new materials. All of these constraints were mitigated by designing sequential, grade-specific programs that address the science curriculum at each grade level. The interdisciplinary nature of the programs allows for the enhancement of other subjects, but tying the program to the science curriculum encourages teachers to make the field trip and to extend the program to their classroom.

Program Development

Elementary science objectives in public schools from New Jersey to Hawaii were obtained from the Educational Resources Information Center (ERIC). Table 2 shows the common denominators in science from kindergarten through fifth grade and examples of concepts the Dahlem Center used to bridge the gap between the natural and the built environments. By meshing these concepts with topics relevant to the Jackson area, fourteen program options were selected. An umbrella of project goals and objectives in the cognitive, affective, and skill domains followed (See Table 2 and Figure 1).

Table 2. Common Science Objectives and Bridging Concepts.

Grade	Science Objectives	Sample Bridging Concepts
Kindergarten	Observe with senses -- comparing living and non-living things -- diversity Plant and animal life requirements	Sensing the built and natural environments Seasonal changes Needs of all living things
First grade	Classifying -- organizing Living and non-living things Reproduction and growth Life cycles and change Plant and animal life requirements Daily and seasonal weather changes	Discovering birds and insects in the built and natural environment -- their needs, life cycles, adaptatons, diversity, and habits.
Second Grade	Life cycles Habitat diversity Plant structures and their function	Amphibian life cycles Food chains in the built and natural environment Plant structures Seeds in the built and natural environments
Third Grade	Changes in habitat -- succession Habitats and Organisms -- communities Food chain and web -- interdependence	Forest ecology Decomposition in the built and natural environments Population dynamics in

Table 2 (continued)

	Population growth and change Adaptations Sun energy and green plants	the built and natural environments Food webs in the built and natural environments
Fourth Grade	Organism responses to environmental changes Pollution and conservation Population interaction Food web Interdependence Erosion and weathering Water cycle	Energy in the built and natural environments Interdependence and change in the built and natural environments Decision making Human impact on the natural environment
Fifth Grade	Food chain and nutrient cycles Photosynthesis and decomposition Community and population change Geological changes Adaptations Interdependence	Water quality and water cycle in the built and natural environment Geology in the natural and built environment Natural and human-caused change in the natural and built environments Interdependence in the natural and built environments Problem solving

Figure 1. Scope and Sequence Chart.

		COGNITIVE							AFFECTIVE			SKILLS				
		Energy	Cycles	Diversity	Community	Interdependence	Change	Adaptations	Awareness	Feelings	Valuing	Observing	Classifying	Cooperating	Communicating	Problem-Solving
Signs of Fall	P				•		•		•			•	•	•	•	
Signs of Spring					•		•		•			•	•	•	•	
Nature Prepares for Winter	K		•			•	•	•	•			•	•	•	•	
Who Lives There?			•	•	•	•			•			•	•	•	•	
Interesting Insects	1	•		•		•	•		•	•		•	•	•	•	•
Spring Birds		•		•	•	•		•	•	•		•	•	•	•	•
Nature's Hitchhikers	2		•			•	•	•	•	•		•	•	•	•	•
Frogs and Toads		•				•	•	•	•	•		•	•	•	•	•
Animal Homes and Habits	3	•		•	•	•	•	•	•	•	•	•	•	•	•	•
Forest and Flowers		•	•	•	•	•			•	•	•	•	•	•	•	•
Energy in the Air	4	•				•	•		•	•	•	•	•	•	•	•
Michigan's Natural History				•	•	•	•	•	•	•	•	•	•	•	•	•
Reading the Rocks	5					•	•	•	•	•	•	•	•	•	•	•
Our World of Water		•	•		•	•	•	•	•	•	•	•		•	•	•

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Teacher committees at various grade levels proved invaluable for evaluting and targeting the objectives of the programs. These teachers also critiqued drafts of the packets and tested new ideas and activities. A variety of other resources contributed to the curriculum -- elementary science textbooks, environmental education activity guides, interpretive field guides, county media centers, and professional environmental educators.

Examples

The critical difference between the Dahlem Center's programs and every other environmental education curriculum is the attempt to introduce ecological concepts in the built environment, develop them in the natural world, and apply these concepts in the students' home environment. Several strategies were employed to achieve this bridge.

In the first grade program, "Spring Birds," students participate in fairly typical birding activities at the Dahlem Center -- using binoculars, listening to bird calls, looking for field marks, and comparing beaks and foods. The teacher packet includes activities to introduce and reinforce these concepts, with an emphasis on local, urban birds. Students have the opportunity to observe birds in their neighborhood, make bird models, build bird feeders, and gain in cooperative skills and responsibilities. In this case the topic is the main theme: students study birds in the natural and built environments. Concepts such as habitat management and adaptations play a supporting role.

At older grade levels it is much easier to make the connection with concepts and issues like decomposition and the water cycle. Like other centers, the Dahlem Center has a program that includes exploring ponds for aquatic organisms. "Our World of Water," however, also emphasizes the water cycle and the management issues involved with this critical resource. The quantity of water used by each student in one week and where their wastewater goes plays as major a role in this program as the pond food web. Faucets and toilets may be more meaningful to urban learners than wetlands! By taking a closer look at both the built and the natural environments within the context of ecological principles, students begin to see their world as one interconnected system.

Evaluation

A wide variety of evaluative techniques were used throughout this project. Formative evaluations from the teacher committees and consulting educators allowed for revisions in the packets and field trip programs. Although their comments have improved our programs immensely, formative evaluations are exceedingly time consuming and are part of the reason we have not yet printed all the packets.

Two forms of summative evaluations -- a teacher questionnaire and student pre- and post-tests -- were implemented in 1982. Teacher responses were positive and encouraging. Although the student tests were pilots, they yielded significant, positive results. We hope to complete a more carefully designed evaluation in the future that will better address transferability and growth in the effective domain.

Nine classrooms participated in the testing in two different programs. All students received pre-tests and post-tests that were parallel, but not indentical. The control classes did not receive a teacher packet or field trip; the experimental classes received both.

In both programs, the experimental groups' scores improved significantly, and this increase was statistically greater than that of the control groups (p.05). These results indicate that the experimental groups' understanding of ecological concepts and environmental facts was due to the Dahlem Center's program and not to chance. (Statistics were evaluated by Dr. Michael Walraven of Jackson Community College.) That the control groups also improved is a common pre-testing phenomenon -- some learning results from arousing student's interest in an unfamiliar topic. Interestingly enough, the experimental groups' pre-test score was higher than the control groups' pre-test score. This may be due to the non-random selection of classrooms; experimental classes were chosen from teachers who bring their classes to the Dahlem Center. They may teach more environmental concepts and awareness throughout the year than the non-participating teachers who were selected for the control classrooms.

Summary

The school programs at the Dahlem Environmental Education Center represent a first step toward helping urban learners make sense of their world by drawing strong connections between the natural and the built environments. In addition, the series is sequential, grade-specific, and supplements the science objectives in elementary schools. These features encourage teachers to bring groups to the Dahlem Center year after year and to extend the program to their classroom with pre-trip and post-trip activities, which strengthen the transferability of ecological concepts.

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Paper Number 38

Morris, Stephan and Tom McMakin. "Toward a Theory of Dwelling." Environmental Studies, Oberlin College, Oberlin, Ohio 44074.

In our paper we present a model of morality which is useful in the consideration of humans as both solitary in, and interactive with, their natural environments. This model emphasizes the role of choice as determinative in moral agency, and maintains that a healthy moral agency is fully conscious, personal, and choice-full, or at least is rooted in such agency (thus conventional morality is not, perforce, unhealthy). We elucidate at some length how what we call the primary tension of existence sets up the situation in which personal moral choice must be invoked towards survival. The primary tension is the tension of limited resources, induced by Darwin's "hostile forces" (i.e., predators, parasites, diseases, food shortages, and weather). We then sketch out the pathologies to which convention-based action before the primary tension is prone. This leads us to consider the dwelling conventions of our society, and to trace the pathologies of those conventions to roots in the historical evolution of a progress ethic, by which humans are conceived as essentially at odds with nature, and as the evolutionary heirs to total dominion over it. Finally, we take up the task of directly addressing environmental educators, concerning what we perceive as their crucial role in the healing we must undergo, both as a whole society, and as individuals, to varying degrees, warped and mauled by the whole.

To educate is to lead. Leading, in turn, can take a variety of forms. Leaders can guide, or draw along, or command, or motivate. They may be merely titular leaders, who appear first in protocol hierarchies. In a more mundane sense, leaders may simply be experiences; they may simply live in such a way that others may also live, like them.

Environmental educators must dwell consciously to teach conscious dwelling. This is no more than the most basic injunction against hypocrisy. But it carries, also, special urgency in this context. Environmental educators are presented in our society's dwelling with pathology that will not yield to didactic pleas, or to impassioned demands, or (perhaps especially) to intricate theory. Education about dwelling can only take place through inducing radically new dwelling sitations. From the background of existence, voices must be called forth which once spoke about conscious choice before the primary tension, but which now are silent in our artifically tensionless experience. This calling forth involves direct confrontation of the progress ethic, and its manifestations in our lives. This confrontation is a way of reclaiming primordial freedom - the freedom possible only under the direct influence of the primary tension. Only under the primary tension is the human agent truly presented with choice. To choose to live is the most ancient prerogative of the free human being. The primary tension is the situation which poses that choice; to feel the tension, then, is to know the most ancient form of freedom.

Environmental educators must teach the ancient forms of dwelling, both literally and metaphorically. Literally, they must make integral to their curricula experiments in non-conventional dwelling, in all seasons. Metaphorically, they must motivate reflection in their students about the nature of choice, freedom, and action in the situation of the primary tension. Choice, freedom, and action are truly the old forms of human dwelling, for it is out of their interrelation that emerge the paradigms for all forms of dwelling. Experiential and simultaneous conceptual access to the old form, and the primary tension which conditions them is essential to healthy action out of the primary tension. In our paper we speak little of what such healthy action actually constitutes. The variety of human experience stands as ridicule of any attempt to offer comprehensive programs for such a general phenomenon as dwelling. We do not recommend specific forms - rather, we urge a primordial process. Humans must be cast into consciousness before the primary tension. It is the choosing, and not the choice itself, that matters.

Martin Heidegger states that "mortals must ever learn to dwell." The vital insight of his remark is the equivalence it poses implicitly between learning and dwelling. If mortals must ever learn, then dwelling is simply ever learning. The progress ethic is pathological because it arrests that learning through the installation of background conventions which make of dwelling an activity no more momentous than excreting. The progress ethic promotes the stagnation of human dwelling, which induces the alienation of human moral agents (alienation epitomized in the condition of the slum-dweller). This alienation is the cue of the educator, to re-induce original consciousness of the problem of dwelling, to re-inform the human individual of the primary tension. The assumptions of the progress ethic are distinct from the pure light of direct consciousness. To be mediated before tension by no more than moral agency is to be, in the most basic sense of the word, free. Out of this freedom, choice is possible - the learning of which Heidegger speaks. This learning in turn motivates new consciousness, for learning enhances knowledge, and consciousness is the medium of knowledge. We see in this process of self-renewing learning an improvisational structure for healthy human dwelling. To be healthy, human dwelling must be founded on personal moral choice and self-initiated action. Self-renewing learning is a structure that assures the recurrence of choice in dwelling. At the same time it is substantively unconstrained - it allows the necessary room to human dwellers for improvisation (for they will always learn new things, anew).

We believe that for each abstract directive we offer in our paper there are real programs that could be implemented towards enriching the dwelling orientation of individuals, and reawakening the primary tension in their lives. We leave to the imagination of the reader the details of these programs and their implementation. In our paper, we seek only to present a vision, a thought about and its implications for the dwelling of individuals in this society. Our vision is no more than the contemplation of possibilities. Yet by such contemplation we are free, we dwell, and we are alive.

Paper Number 39

Mukhopadhyay, M. and S. Mukhopadhyay. "Technological Transformation and Cultural Mainstreaming." Technical Teachers Training Institute, Bhopal, India; Regional College of Education, Bhopal, India.

This is the story of a small, heavily populated village with strong cultural traditions in education, recreation, and festivities;

a leader among the surrounding villages.

In 1978, the village experienced a devastating flood which left only the tall trees. In its reconstruction effort, the government provided modern housing, electricity, and all-weather roads to the city. Villagers spent their savings to construct brick houses. Next, the movie theatres, household television sets, buses and automobile services, etc., came.

Today, one does not get up with the morning chanting of hymns, nor does one hear the sweet melodies of the bamboo flute that refreshed the tired peasants at the day break. One misses the spacious yellow ochre houses and natural smell of mudwash and the village no longer rejoices in a village drama.

This is an excellent case study of technology - housing, occupational patterns, transportation, recreation, etc., - shaping the culture of a village. With its new economic and material status the village changed its culture and lost its enviable environment (free from dust, burnt petrol, diesel gases, and water pollution, etc.).

Paper Number 40

Olson, E.C. "Environmental Education and Interpretation As Management Tools for a Natural Resource Agency: A Case Study in Non-Formal Environmental Education." Division of Environmental Education, The Ohio State University, Columbus, Ohio 43229.

A visitor education strategy was developed, implemented and tested for its effectiveness in raising levels of knowledge and attitudes toward nature preserve management. Visitor sociodemographic and site-specific data were also collected and analyzed. A stratified random sample of visitors to four Ohio state nature preserves was taken and visitor sociodemographic, site-specific, knowledge and attitude data were obtained by a 35 item questionnaire. Results from 1,141 completed questionnaires showed preserve visitors to be mostly male, age 20-39, with an income of $10,000-$30,000, with few holding memberships in either community or conservation groups. Most were frequent visitors to state nature preserves, were very satisfied with their most recent visit, and came to the preserves with family or friends for solitude and to sightsee. A pretest of visitor knowledge of and attitudes toward select nature preserve management concepts showed that visitors had a poor comprehension of the concepts and held negative or neutral attitudes toward them. An environmental education program was developed utilizing interpretive strategies as methods for transmitting information about the preserve management concepts. Post-test scores illustrated gains in both levels of knowledge and attitudes. The largest gains were reported where signs and personal services were the interpretive strategies.

Paper Number 41

Orr, David W. "Education and Human Survival: An Interdisciplinary/ Experimental Approach." Meadowcreek Project, Fox, Arkansas 72051

This paper describes the assumptions, values, and strategies behind the development of a 1500 acre environmental education center serving students and faculty from a network of colleges and universities. The program focuses on science, social science, and humanities aspects of ecology, agriculture, forestry, renewable energy systems, waste cycling, and rural development.

Paper Number 42

Perrine, Richard L. "Education to Address The Impact of Chemicals in the Environment." School of Engineering and Applied Science, University of California, Los Angeles, California 90024.

An important future activity area for environmental program graduates to consider is the impact of release of chemicals. This complex area blends chemistry, biology, the earth and atmospheric sciences, and the transport processes characteristic of engineering. There needs to be a scientifically sound, structured approach, simple enough so that basic concepts are not lost in a mass of detail. Structure is supplied by an appropriate conceptual model: specification of system boundaries, system properties, quantification of transport and fate processes, and material balance. An effective yet relatively simple unifying approach to determining how chemicals may behave may be added through use of the fugacity concept: fugacity as a measure of the "escaping tendency" of a specific chemical from a phase (Mackay, 1979; Mackay and Paterson, 1982). The final step of assessing potential impacts then derives from application of toxicity or other impact relationships, given an enviromental concentration for the chemical of concern.

Models are conveniently based on interconnected cells (Mackay, 1979); each containing a share of air, soil, water, or other media. Transport between cells is often slow compared with transformation processes for chemicals, and these in turn are slow compared with partitioning between media. Thus use of a time scale helps to segregate phenomena and understand which processes are of primary importance for solution of a specific example problem.

Equilibrium Properties

Equilibrium "constants" and properties which can be estimated from chemical structure and/or correlations are as follows:

Water/octanol partition coefficent (Kow) represents a key datum, indicating how a chemical may apportion itself between hydrophylic and hydrophobic media. Solubility (S) can be quite reliably estimated from Kow, and vice versa. A regression relation is as follows (with Tm melting temperature).

$$\mathrm{Ln}\ S\ (\mathrm{mol/m^3}) = 7.494 - \mathrm{Ln}\ K_{ow} + 6.8\ (1 - T_m/T)$$

Water/soil partition coefficient (K_p), water/organic carbon partition coefficient (K_{OC}), and bioaccumulation factor (K_{bio}) similarly permit the estimation of sorption on soils, on organics in soils, or uptake by biota. Because of the variability of chemicals involved, correlations are less precise, but still useful.

$$\mathrm{Log\ Koc} = 0.524\ \mathrm{log\ Kow} + 9.381$$
$$\mathrm{Log\ Kbio} = 0.542\ \mathrm{log\ Kow} + 0.124$$

Where O is mass fraction of organic carbon, we can add the relation: Kp = 0 Koc. It appears that the more important sorption processes for organics likely represent distribution between water and other organics or the lipid fraction of soils and biota. Data for Kbio from one organism appear to correlate with those for another within an order of magnitude (Mill, 1981).

Transfer into the atmosphere involves volatilzation, at equilibrium defined by the Henry's Law constant (Hc): Hc=Pv/ S, where Pv is saturation vapor pressure.

Rate Processes

The most persistent chemicals in the enviroment are frequently also of greatest concern. An advantage of dealing with a persistent material is that it is more likely than others to closely approach local equilibrium and so make the above relations valid. Various rate processes must be considered, however, even if these (such as transport from one cell in the environment to the next, or from water to air) are treated using a separate analysis.

Volatilization from water (a lake or stream) to air can be estimated using a simple two-film model of mass transfer (Smith et.al., 1981). Often the half life of a volatile chemical in a lake, for example, is only a few days. Transfer from contact with soil into the atmosphere is controlled by vapor pressure in soil and movement to the soil surface by diffusion and/or convection in evaporated water. Vapor pressure may be greatly reduced due to interaction with soil, mainly due to absorption.

For chemical transformation reactions kinetic constants couple reactivity of a chemical structure to a specific process. For example, oxidation of a species (initially at a concentration [C] in a compartment of a cell), by a free radical [RO•], may be described by:

$$\text{Rate of Loss (oxidation)} = -d[C]/dt = k_{ox}[RO\cdot][C]$$

Here R represents any appropriate organic chemical fragment. Often a steady background of such radicals may exist, permiting use of just a simple, first-order equation with a modified rate "constant" to describe the process:

$$\text{Rate of Loss} = K^{1}_{ox}\,[C]$$

A kinetic model for fate sums all source and loss rates to obtain a net rate of change. If we index each process by i and let $k^1_i = k_i$ [E], E_i an appropriate environmental parameter:

$$\text{Rate of change} = d[C]/dt = \sum_i k'_i [C]$$

In a real system transfer from cell to cell is often slow and a near steady state is reached such that $d[C]/dt = 0$. Then:

$$C_{\text{steady state}} = \text{Rate}/\sum_i k'_i$$

Half-lives are useful to determine relative importance, and we can estimate:

$$t_{\frac{1}{2}} = \ln 2/\sum_i k'_i$$

Basic transformation processes may occur along either chemical or microbiological routes. Soil microorganisms need sources of carbon, energy, and essential elements. Organic pollutants are readily coupled into this system (Kobayaski, 1982). The role of enzymes in soil biochemical activity is essential.

Heavy metals as well as organics interact with soil, but through absorption-type processes (Leeper, 1978). These substantially influence their mobility, limiting it to a small, constant fraction of the speed of groundwater movement for strongly adsorbed species.

Fugacity: A Useful Approach to Gain Insights Into Behavior

Ideally we would work with the thermodynamic parameter "chemical potential," a measure of driving force for chemical change to model movement of a system toward equilibrium. In practice, however, a related thermodynamic parameter -- fugacity; conveniently thought of as a measure of "escaping tendency" -- is much easier to work with. Fugacity (F) relates very simply to concentration (C):

$$C = Z F$$

where Z is "fugacity capacity," a coefficient characterizing the ability of the substance to have fugacity. When there is equilibrium between media (or compartments), the escaping tendency from one to the other must be equal, thus fugacities are the same.

$$F_{\text{air}} = F_{\text{soil}} = F_{\text{water}} = F_{\text{biota}}, \text{etc.}$$

We will illustrate use of this approach by a simple example problem.

The Altamont Class II-I Landfill

Altamont is a canyonfill in Alameda County in California, with (presumably) well-designed leachate collection and underdrain systems, in an area of relatively tight clay-rich soils. Water quality monitoring to comply with RCRA requirements (Marshak, 1983) revealed escape of volatile organic contaminants from areas believed to contain only municipal solid waste. Test wells both up- and down-gradient permitted an analysis of leachate movement.

Monitored data for a number of chlorinated hydrocarbons were obtained indicating substances and levels of greater or lesser concern. Tetrachlorothylene is an example, for this data are given below:

	Tetrachloroethylene (ppb)			
Date	Well C2	Well C3	Well E2	Well Ji
3/82	19	1.1	<0.5	<0.5
6/82	0.7	-	-	-
9/82	0.5	<0.5	<0.5	<0.5

Well C2 is down-gradient and immediately adjacent to the toe of the landfill, hence these results are not surprising if leachate does escape (though that presumably should not happen). The California water quality criteria for tetrachloroethylene include a 3.5 ppb 1 in 10 cancer risk level. Also, a spring contributes to continuing groundwater flow. hence the observed data are of concern to regulatory officials.

Estimating the Distrtibution of a Toxic

We will use these tetrachloroethylene data in an example estimation of the likely distribution among down-gradient media following release from the Altamont site. This will illustrate the crudity of assumptions frequently required if we are to address any problem using available data, and also the inherent simplicity and usefulness of building on fugacity as a starting point in the analysis.

We will use laboratory-determined data wherever possible, supplementing from correlations where needed as indicated earlier. Thus, we obtain the following:

Temperature -- T = 295 K^3
Water Solubility -- S = 3 moles/m^3
Vapor Pressure -- Pv = 0.02 atm
Octanol/Water Partition Coefficient -- Kow = 200
Water/Organic Carbon Partition Coefficient -- Koc = 38.6
Water/Soil Partition Coefficient -- Kp = 0.77 (soil)
Water/Sediment Partition Coefficient -- Kp = 1.54 (sediment)
Bioaccumulation Factor --- Kbio = 23.5
Density of Soil -- 1.5 x density of water

To obtain fugacity values, we note that:

$$Zair = 1/RT = 41.3 \text{ moles/m}^3\text{-atm}$$

$$Zwater = 1/Hc = S/Pv = 150 \text{ moles/m}^3\text{-atm}$$

$$Zsoil = Kp\ (psoil/pwater)\ Zwater = 173 \text{ moles/m}^3\text{-atm}$$

$$Zsediment = 2\ (Zsoil) = 347 \text{ moles/m}^3\text{-atm}$$

$$Zbiota = Kbio\ \ Zwater = 3525 \text{ moles/m}^3\text{-atm}$$

Further, to convert the observed tetrachloroethylene concentration in water to its corresponding fugacity:

$$F = C/Z_{water} = (19\times10^{-3} gm/m^3)/(166 gm/mole)(150\ moles/m^3\text{-}atm) = 7.63 \times 10^{-7}\ atm$$

We now will assume as a first hypothesis that air, soil, sediment, and biota brought in close contact with leachate escaping from the landfill closely approach equilibrium. If they do so the fugacity in each medium will reach the same value as that deduced above for water. We also use site characteristics to select values for the volume of each medium likely to be in contact with leachate-contaminated water within an example cell. Results are tabulated below.

Environmental Compartment	Volume V, m^3	Z mole/m^3-atm	C = FZ moles/m^3	Quality moles
Air	2×10^4	41.3	3.15×10^{-5}	0.6
Soil	10^4	173	1.32×10^{-4}	1.3
Water	10^3	150	1.14×10^{-4}	0.1
Sediment	10^2	347	2.65×10^{-4}	0.03
Biota	1	3525	2.69×10^{-3}	0.003
			Total:	2 moles

Conclusions

These results suggest (as is quite common) a very high concentration in biota (where toxics may be passed along to sensitive species), though a negligible share of the total is stored within the medium. If the reversal of uptake is not easily accomplished, this can justify serious concern. There is substantial storage within soil though for this particular compound the share is less than for many other substances. At the same time, tetrachloroethylene is more volatile than many compounds of interest, leading to expected transfer to the atmosphere. A likely consequence is a less persistent presence than some other organic chemicals, though also with a risk of increased exposure if sensitive, breathing species inhabit the surroundings. We note that toxics are observed in water, certainly a result of groundwater contaminated by unanticipated mobility of leachate. However, this source medium itself is expected to contain only a very small share of the total toxic present.

As suggested earlier, extension of the approach based on fugacity to analysis including non-equilibrium is straightforward (Mackay and Paterson, 1982). More relationships -- to include mobility and transformation processes -- must be included. Fugacity remains a simple, understandable parameter which helps structure the problem in a sound and efficient way. This is needed because problems are complex, site-based data are few, and very substantial simplification is needed to achieve a manageable problem statement.

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Paper Number 43

Peterson, Edward M. "American Enviromental Interpretive Centers: A Comparative Analysis." School of Natural Resources, University of Michigan, Ann Arbor, Michigan 48109.

Throughout the United States there exist some 2000 environmental interpretive centers. Most of these have come into being within the past 30 years and range from public visitor centers to corporate information centers. Each of these has its own mission and method of achieving its goals.

This project examined a cross section of environmental interpretive centers across the United States. It identifies commonalities and differences in the experience of day-to-day and year-to-year operation, and develops a set of guidelines for effective operation.

Paper Number 44

Peyton, R. Ben, Larry Gigliotte, Tom Lagerstrom. "Public Perceptions of Sludge Application on State Forest Lands: Implications for Resource Education." Department of Fisheries and Wildlife, Michigan State University, East Lansing, Michigan 48824.

In 1980, the Michigan Department of Natural Resources (MDNR) received funding from the Environmental Protection Agency to investigate the feasibility of applying sludge to Michigan's state forest lands as a means of municipal sludge disposal. One component of the feasibility study was an assessment of public perception and acceptance of sludge disposal technologies: incineration (Inc.), landfill (L.F.), forest (F.A.), or agricultural land application (Ag. A.). This study of public response occurred in two phases. One phase surveyed Northwest Michigan residents to determine public value priorities, belief systems, and attitudes to guide public education and involvement efforts by state or local agencies, should forest application prove a desirable technology. A smaller study investigated differing responses by residents of two counties to pilot forest application projects in their counties. Kalkaska County residents rejected the F.A., while it was accepted by Montmorency residents.

In both studies, a questionnaire mailing was followed by a postcard reminder and a second questionnaire mailing to non-respondents. Random lists of subjects over 20 were generated from drivers license records. Five hundred each were selected for Kalkaska and Montmorency Counties. The larger survey included 400 subjects from each of five counties in Northwest lower Michigan and two from the upper peninsula. Counties were selected on the basis of existing municipal sludge problems and available state forest lands. The general survey (G.S.) response rate was 61 percent of deliverable surveys (9.6% undeliverable). Response rate from the two counties was 61.2 percent (N= 547, 9.8% undeliverable). A telephone survey used to follow up nonrespondents in the G.S. indicated nonrespondents differed only in being more undecided about the sludge disposal issue and their skepticism towards the MDNR.

More G.S. respondents (45%) were undecided about the acceptability of forest application (F.A.) than were opposed (30%) or in favor (25%). In the pilot county survey (PCS) about 44 percent were opposed in both Kalkaska County (19% favored, 37% undecided) and Montmorency County (19% favored, 37.1% undecided). Incineration was the disposal technology preferred by 33 percent, followed by F.A. (23%), L.F. (20%), and Ag. A. (16%). No opinion was expressed by 8 percent. The strongest predictor of attitude towards F.A. was the evaluation of F.A. relative to the health, environmental and economic impacts of the three alternative technologies.

Activism is highly related to attitude to the F.A. proposal. Of those opposed, 71 percent intended to get involved if such a project was proposed. Only 42 percent of those in favor expressed similar intentions. This is supported by the high proportion (70%) of activists who were opposed in Kalkaska County. Both attitudes were equally represented among Montmorency activists.

Respondents exhibited low levels of technical knowledge about F.A. Frequent "Don't Know" responses indicated an absence of knowledge rather than incorrect belief systems.

Respondents were asked to distribute 100 points to four value concerns used to evaluate sludge disposal methods. Human health was highest X = 50.9), followed by enviromental quality (X = 22.1), economic costs (X = 13.5) and aesthetics (X = 13.4). These value priorities were ranked similarly by most publics.

Evidence existed that a strong preservation value operated in a minority (10%) of respondents. This group strongly agreed that it was wrong to dump sludge in our forests, irregardless of whether bad effects were caused. Response on this item accounted for more variance in attitude towards F.A. than the other values (health, environment, economics, esthetics) and was not correlated with these values.

Respondents who opposed forest application tended to be younger, less educated, and more rural residents with stronger environmental value orientation than supporters or individual respondents. Opponents also were more skeptical of MDNR and other government agencies, and preferred Inc. and L.F. technologies.

Supporters of F.A. included a larger proportion of males, farmers, or retirees and had a lower environmental value orientation and a higher relative concern for economic consequences of sludge disposal.

Respondents expressing an intent to become involved (32%) tended to be younger and included more males, rural residents, skilled and professional workers, and members of organizations than uninvolved or undecided respondents. This group also had higher environmental value orientations.

Those who were undecided on F.A. and the extent of their future involvement, included more females, more sale/clerical, homemaker, and unemployed workers, tended to be urban, and had environmental orientations almost as strong as involved respondents.

Skepticism was one of three variables leading to a different response in the two pilot counties. Kalkaska residents were more skeptical due to past natural resource issues in the county. They also resented importation of sludge from southern Michigan (local sludge was used in Montmorency County). Finally, the use of a council of governments (NEMCOG) facilitated acceptance of the pilot proposal in Montmorency County.

About 1/3 of G.S. respondents were skeptical of Michigan DNR programs and felt that local and state agencies would not manage a F.A. site properly. About half expressed confidence in MDNR programs and 65 percent believed a F.A. site would be properly managed.

Universities and the Michigan Departments of Agriculture and Public Health were perceived as the most accurate sources of information from a list of 13. Several other sources were ranked closely below these, including the MDNR. Local government officials and industrial sources were perceived as lowest. Ironically, respondents indicated their primary source of information about sludge disposal would be news media, even though they ranked media low in their list of accurate sources.

Findings indicate this is an emerging (rather than disruptive) issue, considered an important problem by Northwest Michigan residents. Controversy about the issue will be generated more by conflict in belief systems than value priorities among publics. Most publics evaluated sludge disposal methods with the same value priorities, but used different beliefs concerning sludge disposal consequences in the evaluation process. An exception was the preservationist groups which were opposed regardless of their technological knowledge or beliefs about F.A. effects. Existing public perception of this issue suggests a public education and involvement program can be effectively initiated to resolve municipal sludge disposal problems of many Michigan cities, if research indicates F.A. to be ecologically and economically feasible.

Paper Number 45

Peyton, R. Ben and Charles LaValley. "To R.A.P. or Not to R.A.P.: A Values Education Curriculum for Middle Schools." Department of Fisheries and Wildlife, Michigan State University, East Lansing, Michigan 48824; Michigan Department of Natural Resources, Law Enforcement Division, Lansing, Michigan 48909.

This multi-media curriculum was designed to serve both the needcs of the Michigan Department of Natural Resources (MDNR) and general education goals. The materials alert students to the existence and use of the R.A.P. program (Report All Poaching) and provide an opportunity to involve the students in the value and moral questions involved in the poaching issue. In a value-fair environment students learn of the roles of values and beliefs in creating and resolving issues. They also develop skills in identifying, evaluating, and prioritizing these components.

The curriculum draws on several values/morals education models including Kohlberg's moral reasoning, the inquiry model and values clarification. Students view two filmstrips which present moral dilemmas concerning poaching. Two other filmstrips inform students of the extent and nature of poaching in Michigan. A final filmstrip provides a summary of reasoning levels that may exist relative to poaching. The extensive discussion following each of the filmstrips is guided by detailed instruction in the teacher's manual and a student workbook.

During the presentation, participants will be introduced to the strategies and theory of the program. Certain activities will be selected for audience participation.

Paper Number 46

Rajput, J.S. and A.B. Saxena. "Oriental Value Systems As the Basis of the Environmental Education in India." Regional College of Education, Bhopal, M.P., India.

Developing countries have their own enforced priorities. Limited resources and a large population require attention in the formulation of all plans and policies. This includes education; particularly the universalisation of education. The propensity to adopt sophisticated technologies often inadvertently ignores the resources available in terms of the social and cultural environment. Consequently, this leads to poor implementation.

Several value systems exist in developing countries and regions which could be utilized for the promotion of the concept of environmental conservation with social sanction and even religious backing. This can be exploited without much effort and linked with present day trends. The authors present examples of practices and customs which can be utilized in environmental education programs and discuss their importance and relevance vis-a-vis the developing sophisticated technologies. Certain suggestions based upon field experiences gained in Indian situations in implementation of these efforts are also summarized.

Paper Number 47

Roth, Robert E. "A Workshop Model for Environmental Education in Developing Countries." Chairman, Division of Environmental Education, School of Natural Resources, The Ohio State University, Columbus, Ohio 43210.

A global interdependent web links developed and developing countries, economic and environmental issues, and natural resources management and education. At a recent meeting of the International Development Conference held May 17-19, 1983, Commonwealth Secretary-General Shridith S. Ramphal said "The real argument is not yet about what we should do. It is still about 'why' we should do anything." While the world has grown progressively wiser about economic development and environmental quality including the need for pollution abatement, a reluctance to act is still very much in evidence. Effective leadership remains in great need. Similarly, Dr. John Kenneth Galbraith has persuasivly made the point that "....education is a critical, highly effective, and often overlooked precursor to healthy development."

Because of an unshakable belief in the need for sound environmental management, well conceived education and environmental programs, and highly skilled professionals available throughout the world, faculty of the Division of Environmental Education in The School of Natural Resources at the Ohio State University have embarked on a major endeavor to: (1) become skilled in international environmental education and development work, (2) to provide technical assistance, expertise, and to develop materials as appropriate for governmental agencies, NGO's and the private sector, and (3) to promote the higher education of practitioners in the field of environmental education.

The Division of Environmental Education has initiated several projects of significance for the Caribbean region that portray concepts related to international natural resources development and environmental management education, and that will provide meaningful educational experiences for our students, both domestic and foreign, and that train faculty for international development work by providing involvement with developing countries interested in improving their capability in natural resources management and environmental education.

General Objectives

The objectives of the title XII projects were to: (1) establish cooperative working agreements with the Caribbean Conservation Association in Barbados and the Ministry of Agriculture in the Dominican Republic for environmental education development; (2) develop a targeted environmental education manual appropriate for Barbados; and (3) plan a conservation/environmental education workshop model or seminar for the training of selected agency and educational personnel in each country. The workshop model and seminar was designed for subsequent use in each host country.

Benefit to the Division of Environmental Education included development of strengthened international components in two existing general natural resource courses and the development of a new environmental education module emphasizing international environmental education program models for a graduate level course. Faculty of the Division also participated in Spanish language training.

Major Accomplishments and Activities Undertaken

(FY '82 Title XII U.S. AID) Three areas of activities were pursued in relation to natural resources conservation and environmental education development in the countries of Barbados - with emphasis on the Caribbean Conservation Association and the Dominican Republic - concentrating on the Ministries of Agriculture and Education and a selected university (Universidad Pedro Henriquez Urena). The first area was one in which selected representatives involved with environmental education in Barbados (one individual) and the Dominican Republic (three individuals) were brought to OSU to discuss needs and to provide guidance in relation to the development of the Barbados draft manual of environmental education activities, the prototype workshop/seminar model and program development needs.

Three project faculty (Drs. Disinger, Shepard, and Roth) visited the Dominican Republic for two weeks (2/8-19/82) to meet with key individuals representing various agriculture and natural resources oriented agencies, organizations, and institutions. Various sites were visited to assess natural resources problems, observe educational programs in operation with campesinos, and to gain better understanding of the available environmental and cultural resources of the country. Three slide/tape modules in Spanish translation on "composting" were subsequently developed and produced for use in the Dominical Republic.

Secondly, a 160-page draft modification of the proposed manual of environmental education activities for Barbados was developed and edited for distribution. The third area consisted of the development of both an appropriate workshop and a seminar model that would achieve objectives specified by the respective host countries.

The third area of the project completed during 3/22-29/82 by the principal investigator established on-site contacts and resulted in visits to various programs related to environmental education in Barbados.

A Workshop Model

A workshop was designed to incorporate an in-country staff counterpart in relation to each topic presented. Similarly, the various aspects of the program incorporated responses to the wide array of needs identified during pre-workshop inventories and needs assessments. Workshop structure was established to follow the conventions normal in the host country as to starting and termination dates and times, lunch and/or refreshment arrangements, field trip practices, and protocol activities that involved governmental and private sector representation. A four day time span was viewed as optimum by the participants. Funding agencies in contrast usually encourage a minimum of two weeks involvement for economic reasons.

Goals utilized include the following:

1. Increase awareness of environmental issues and content related to those issues;

2. Identify environmental education materials of use in the teaching/learning process;
3. Assist in the development of an array of environmental education activities that are of immediate use.

Workshop Structure

Day 1		Opening Ceremony Introductions Orientation Inventory
	Activity I -	Group Dynamics Philosophy and Structure of Environmental Education Ecological Concepts
	Activity Period II -	Food Web Simulation Assignments and Arrangements
Day 2	Activity Period III -	Shore Field Trip
	Activity Period IV -	Environmental Inventories Defining Concept and Content for Objectives Resource Materials Assignments and Arrangements
Day 3	Activity Period V -	Soils of the Region Field Trip to a Cave Lunch
	Activity Period VI -	Forests and Wildlife Conservation
	Activity Period VII -	Energy Impacts of Food Simulation Assignments and Arrangements
Day 4	Activity Period VIII -	Teaching Materials Development
	Activity Period IX -	Activity Presentations
	Activity Period X -	Summary and Evaluation
	Closing Ceremony -	Awarding of Certificates

Evaluation of the Workshop model and processes revealed several factors of use in subsequent workshop activity:

1. Pre and Post Inventory of Environmental Management Knowledge and Attitudes: Knowledge gain was in evidence among all participants and an attitude shift toward a positive view of environmental management was identified.
2. Workshop Model Evaluation
   Workshop model evaluation identified need for:
   (a) A different daily termination time (3:00 p.m. rather than 5:00 p.m.);

(b) A desire for field trips after the lunch break; and
(c) Workshop availability at times other than during holiday breaks.

3. Classroom Activity Checklist of Teachers Perceptions: Teacher's self inventory of currently used activities provided a basis for further analysis to determine affect of workshop participation on teacher's classroom performance.
4. Constraints Identified
   Constraints to environmental education implementation included:
   (a) curriculum organization;
   (b) concept delineation in existing materials;
   (c) national testing programs that did not include environmental education concepts; and
   (e) curriculum materials availability.

FY '84 Title XII U.S. AID Proposal

Project objectives hopefully to be accomplished during FY '84 (submitted 6/15/83) and dependent upon funding include the following:

1. To assist in the development of a National Environmental Education Plan and to help conduct a National Seminar on Environmental Education in cooperation with personnel of the Ministry of Agriculture and La Universidad Nacional "Pedro Henriquez Urean" (UNPHU in Santo Domingo, Dominican Republic).
2. To plan, develop, and conduct a model Environmental Education Workshop on educational simulations for selected social science teachers and teacher educators in cooperation with the Caribbean Conservation Association and Barbados Community College, the University of West Indias - Cave Hill, in Bridgetown, Barbados, tentatively in April 1984:
3. To develop an evaluation strategy of use in further refining existing Environmental Education Activities materials in relation to defined needs for both Barbados and the Dominican Republic.
4. To continue Spanish language training for selected Division faculty;
5. To further modify two existing environmental education courses by incorporating instruction case studies and examples.

The Division of Environmental Education is the only academic unit in the United States that offers both well developed undergraduate and graduate programs in Environmental Communications, Education, and Interpretation. Faculty provide leadership to the field through operation of the ERIC national information clearinghouse, the editing of professional journals, and by serving in a wide variety of professional capacities ranging from instruction to research and public service throughout Ohio, the nation, and on a variety of international projects.

The unique contributions of the Division faculty have helped to establish local, state, national, and international leadership of The Ohio State University in Environmental Education. Faculty of the Division of Environmental Education at OSU are pleased to be a part of this essential process in the development of sound natural resources and environmental management programs appropriate for helping to achieve a quality life for all.

Paper Number 48
Schar, John F. "The Implementation and Evaluation of Microcomputer Simulations in a College Level Environmental Education Course."
Division of Environmental Education, The Ohio State University, Columbus, Ohio 43210.

1. Introduction

The study was based on assumptions relating to environmental education, simulations, and computer-assisted instruction.

The first assumption is that there is a need to teach natural resources students about the complex interrelated processes involved in environmental problems. It is easier to teach about individual concepts than to teach how these concepts interrelate in the processes of the environment. One of the best methods to teach about these processes is through direct experience, but it is often impractical due to cost, time, and safety.

Secondly, simulations have been shown to be a practical substitute for the direct experience teaching method. The simulation creates a model of the real world that can then be manipulated and controlled by the student. Realism is the key to good simulations but realism requires increased complexity in order to accommodate the interrelations occuring.

The third assumption is that computer programs have the capability to create models that simulate real, controllable worlds. The computer can handle the complex interrelationships needed to model and simulate environmental problems. The computer can also provide interaction between the individual student and the model. Once a tool for only the largest universities, computers are now more affordable, versatile, and available in schools at all levels.

Computer simulations as a teaching method are difficult to assess because of the new technology, untested programs, and open-ended learning processes. Due to the number of known and unknown variables involved, this study was exploratory in nature. Results are intended to provide a foundation for further research concerning computer simulations and their applicability to environmental education.

2. Objectives

The objectives of the study were to:
... select courseware applicable to environmental education curricula;
... implement some courseware into the Natural Resource 201 course;
... measure the cognitive gains of students using

factual recall and relationship perception instruments; and

... measure any shift that might occur in the students' attitude toward computers.

3. Procedures

Commercial courseware was reviewed and selected for the study. The actual number available was limited by the constraints of subject matter, grade level, computer brand, class time, and teaching method. Fewer than ten were identified as applicable to this study based on these restrictions.

Individual learning modules were developed for three of the simulations. The specific courseware used for the modules consisted of two simulations produced by CONDUIT entitled Ecological Modeling and Demographics and the LIMITS simulation from the Minnesota Educational Computing Consortium. The modules were designed to be stand alone units requiring little teacher supervision. Pretests were given randomly to measure the students' attitude toward computers and their perception of relationships in the environment.

The computer modules were incorporated into the Natural Resources 201 course at The Ohio State University. This is an introductory level course dealing with natural resource management concepts. One half of the class was randomly chosen to use the computer based learning modules while the rest of the students used comparable non-computer modules. Students in both groups completed the modules as outside work.

Through student and researcher observations the modules were evaluated as they were being completed. Post test measurements included instruments for the students' attitude toward computers, the students' perception of relationships in the environment, and factual recall of concepts taught in the modules.

4. Results and Conclusions

Results and conclusions of the study indicated the following:

1) There are computer simulations available for environmental education curricula, although there are few high quality programs.
2) Microcomputer simulations can be implemented into a college level natural resources management course as individual learning modules.
3) The students' attitude toward computers, especially enjoyment, appears to shift, although the shift was not statistically significant (see Table 1).
4) Factual recall was better for the computer students (see Table 2).

Table 1. Computer Attitude Pre-test and Post-test Results for Students Completing Computer Learning Modules and Students Completing Non-computer Modules Scored as Mean Item Responses by Attitude Dimension.

	Computer Group			Non-computer Group		
Dimension	Pre	Post	Diff	Pre	Post	Diff
Enjoyment	21.30	18.76	-2.54	18.61	18.45	-0.16
Anxiety	11.50	11.17	-0.33	10.50	10.32	-0.18
Efficacy	13.90	14.42	+0.52	13.50	14.28	+0.78
Policy Concern	13.20	14.01	+0.81	11.83	11.89	+0.05
Educational Support	14.10	12.42	-0.68	12.12	12.06	-0.06
	N=10	N=12		N=18	N=18	

Table 2. Scores on Subtest of NR 201 Final Exam For Students Completing Computer Learning Modules and Students Completing Non-computer Modules.

Group	Number of Cases	Mean	Standard Deviation	t	Prob.
Computer	40	7.10	1.236	4.38	0.039
Noncomputer	39	6.44	1.569		

Implications

Simulations can be considered a promising application of the computer for environmental education, but further study is needed to assess their educational value. Although the implementation process of computer simulations into a college level course was successful their effectiveness as tools to teach interrelationships was not determined.

To be more effective these simulations should probably be used in upper level courses where more teacher-to-student interaction and more student-to-computer interaction can be accommodated.

There is a need to further investigate computer simulations as a method for teaching decision-making and problem-solving techniques. These skills, along with complex interrelationships, cannot be easily taught through normal classroom methods.

There is a need to develop more high quality computer simulation courseware for environmental education.

Computer simulations as a teaching method are not applicable to all students or all teachers, but they can help to individualize instruction.

Paper Number 49

Schneider, Michael. "The Outdoors: Using It to Teach Effectively." Pontiac School District #105, Fairview Heights, Illinois 62208.

With the increasing push toward outdoor recreation, it is time to get outside and involve students in the natural world. They need to be made aware of the pressure man is exerting on the environment and how this will, in turn, affect them. By making students aware of the real world, it is also possible to educate them about practical ways of taking care of the environment while still enjoying all the wonders it has to offer.

At Pontiac District #105 in Fairview Heights, Illinois, students can actually touch, see, smell, hear, or even taste what is being taught. Suddenly, learning science has become fun and involvement is the key. The outdoor science program is reaching students at an early age, making them more aware of the environment and the need to conserve and protect it.

By using older students as teachers, it is possible to have small groups with total participation. After the students perform an outdoor science activity, the learning process does not stop. The program provides follow-up experiments and reports which the students can either do back in the classroom or at home. In this way, the teacher can follow through with what has been taught outdoors and successfully evaluate the student.

Though an outdoor lab is part of the program, it is not a requirement. Many science activities can be performed outdoors with only a minimal amount of additional work. A row of sunflowers, a rotting log, a tree, a bush, a mound of dirt can create numerous science activities for students to become involved with.

Paper Number 50

Scholl-Wilder, Melinda. "Significant Childhood Environmental Learning Experiences of Suburban/Urban Environmentalists." Model Laboratory School, Eastern Kentucky University, Richmond, Kentucky 40475.

1. Introduction

An effective curriculum is one of the major issues in environmental education. A study was designed to discover if there are significantly similar childhood environmental learning experiences that are influential in forming the environmentalist characteristic of suburban/urban residents. This information would be valuable when designing an effective environmental education curriculum.

The goal of environmental education is to produce a knowledgeable, aware citizenry that will be motivated to deal competently with environmental issues (Hungerford, et.al., 1980; Hungerford, 1983; Stapp, 1974; Tanner, 1980). A person which has these characteristics is said to be an environmentalist. How does an environmental educator develop a curriculum to accomplish this goal?

This question has been recognized as a major issue or problem (Stapp, 1974; Tanner, 1974; Troy and Schwaab, 1982).

Basic to the curriculum issue is the question of types of learning experiences necessary to reach the goal of environmental education. Should the experiences be cognitive or affective, problem solving or traditionally factual, sequenced or non-sequenced? Much has been written on this question. Studebaker and Tanner believe that the affective components of the goal should be developed through many small subtle acts similar to instilling love of country. Stapp's writings indicate that research shows little correlation between values and cognitive achievement (Stapp, 1974). Consequently, an informed knowledgeable student may not be motivated to act on environmental issues.

The variety of ideas and opinions that exists exhibits a need for a technique to determine which learning experiences will result in the desired outcomes. Curriculum specialists demonstrate that educators generally select learning experiences by hypothesizing which will be most effective, trying them and then evaluating their results. Only in some cases is research used as a basis for selecting learning experiences (Nichols and Nichols, 1978). Environmental educators use similar procedures. Tanner affirms that teaching ideas are tried and revised rather than applying research ideas (Peterson and Hungerford, 1978). Hungerford and Childress agree that the lack of descriptive research into existing environmental education programs encourages the use of common sense or intuitive curriculum development (Childress, 1978; Hungerford, 1983).

Tanner is a strong proponent of the use of research for curriculum development. He believes environmental educators should study the childhood experiences of environmentalists to discern consequential elements (Tanner, 1974). In his study of significant life experiences of professional members of environmental citizen groups, Tanner found several categories of influence that were closely correlated with the attribute of environmentalism. These categories were the outdoors, childhood habitat, parents, teachers, books, adults other than parents or teachers, habitat alteration and solitude (Tanner, 1980).

A small number of researchers have investigated the learning experiences that are necessary to develop environmentally knowledgeable, aware, and motivated citizens. Cyphers was particularly interested in what experiences were necessary to induce elementary teachers to implement environmental education programs. He concluded that teachers who participated in varied, direct outdoor experience prepared similar experiences for students more frequently than those teachers who had not participated in outdoor activities (Chyphers, 1961). Peterson and Hungerford studied the developmental variables affecting environmental sensitivity of professional environmental educators. They determined a number of predictor variables for environmental sensitivity development in these educators. The variables were similar to the categories discerned by Tanner.

With this theorectical basis, the objectives for the study of suburban/urban environmentalists were to: 1) determine what childhood environmental learning experiences were influential in shaping the environmentalist characteristic of suburban/urban residents, and 2) to test the hypothesis that these childhood learning experiences were significantly similar among these environmentalists.

2. Methods

Data was collected through a survey instrument, the Childhood Learning Experiences Questionnaire, designed to determine significant childhood experiences, their settings, atmosphere, and frequency of occurence. Specific items were developed from the eight categories of significant experiences discovered by Tanner in his preliminary research (Tanner, 1980) and from the belief that science knowledge is a desirable component of an environmental education program. Respondents were asked to rank the influence of various experiences and the settings in which they occcurred.

The questionnaire was mailed to 145 randomly selected members of the Cincinnati Nature Center and the Miami chapter of the Sierra Club. All participants lived within the Cincinnati Standard Metropolitan Statistical Area thereby insuring their suburban/urban residency. To guarantee that neither organization had a greater influence on the results, a systematic sampling with stratified groups was employed.

3. Results

The first objective of determining influential childhood experiences was accomplished by calculating the relative frequencies for each category on the survey instrument. Table 1 summarizes the categories of influence and their relative frquencies. The most significant influences identified were contact with the outdoors and the family. These results are similar to those of Tanner (1980) and Peterson and Hungerford (1980).

To test the hypothesis that the influential childhood environmental learning experiences were significantly similar among suburban/urban environmentalists, the average rank for each experience was calculated. These results are also shown in Table 1. The two learning experiences found to be highly influential and significantly similar were contact with the outdoors and the family. Therefore the hypothesis was verified for two categories.

These influential experiences most often occurred as daily play experiences, family vacations, outdoor sports participation, and weekend trips. (See Table 2.) The atmosphere of these experiences was "very positive" to "positive" (95.2%) and generally transpired in groups of one to five (94.0%). The frequency of these experiences was most often daily to weekly (79.8%).

4. Conclusions

This study contributes to the research base from which environmental educators can more effectively derive an appropriate environmental education curriculum. The results of this investigation support previous findings mentioned earlier in this report. The accumulating conclusions have some meaningful implications for environmental education curricula.

TABLE 1. Childhood Influences.

	Relative Frequency	Average Rank
Contact with the outdoors	94.0%	1.46
Family	79.8%	2.12
Alteration of a Natural Area	44.0%	3.27
School science of environmental education programs	42.8%	3.50
Non-familial adults, other than teachers	40.5%	3.62
Teachers	36.7%	3.97
Others (reading, news reports, public park programs, etc.)	21.4%	2.39

TABLE 2. Settings of Childhood Influences.

	Relative Frequency	Average Rank
Daily play	77.4%	1.77
Family vacations	63.1%	2.43
Outdoor sports participation	53.3%	2.70
Weekend trips	46.4%	2.85
Outdoor oriented youth groups	40.5%	2.94
Summer youth camps	34.4%	3.54
School science programs	24.4%	4.27
Other	17.7%	2.06
School environmental education programs	12.2%	5.45

1) Environmental education programs should involve direct daily to weekly contact with the outdoors in small group settings. This is an unrealistic expectation of most school programs. More practically, environmental educators should promote and support settings in which children can gain daily outdoor experience such as neighborhood parks or green areas, natural area school playgrounds, school nature preserves, etc.

2) Environmental educators should provide more experiences for the family. Family influence was demonstrated to be important in the sample population. This data argues for the support of and involvement in situations that cultivate this influence such as summer family environmental education programs, good state and regional park interpretive programs, school programs with parental participation, family oriented environmental education centers, etc.

More research is needed to determine what are appropriate experiences for an effective environmental education curriculum. Curriculum designers should be encouraged to use the available research when designing their programs so that the goal of an environmentally knowledgeable, aware, and motivated citizenry will be more efficiently achieved.

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Paper Number 51
Schultz, Judith M. and Debra Arnold. "Acid Rain: Tracking the pH in Southwest Ohio." Director, Environmental Control/Protection Technology Program, Raymond Walters College, University of Cincinnati, Cincinnati, Ohio 45236.

Acid precipitation, comprised of rain and snow with pH below 5.6, has been identified in recent years as a critical and classical environmental problem transecting national and state boundaries. Normal rainfall is also slightly acidic due to the reaction between carbon dioxide and water to form carbonic acid. Automotive and industrial emissions of SO_x, NO_x, and to a small extent HCl, act as precursors of acid rain which take the form of sulfuric, nitric, and hydrochloric acids. Principal sources of precursors are fossil fuel fired utility plants, industrial plants, and automotive sources. Sixty percent of sulfur oxides are produced from coal. Approximately half of the nitrogen oxides are produced from stationary sources, while the remaining half are derived from mobile sources.

The U.S. trend toward tall smokestacks, with 429 taller than 200 feet, was adopted from the English as a means to alleviate local air pollution. However, this approach has enhanced acid precipitation by resulting in long distances transport of acid precipitation precursors with subsequent deposition in far distant locations. Canadians also adopted this approach with the tallest stack of 1200 feet being located at International Nickel Company in Sudbury, Ontario. International Nickel emits one percent of world sulfur emissions. Utilization of high stacks has complicated and delayed regulatory procedures, since interstate and international borders have become involved. Two million tons of sulfur migrate annually from the U.S. to Canada, while only one-half million enters the U.S. from Canada. Less than 25 percent of the sulfur contamination of New England originates within the region.

The impact of acid precipitation is critically dependent upon the geology of a given area. Limestone bedrock in conjunction with basic soils neutralize acidic rain or snows, thus reducing impact. This is true of the Southwestern region of Ohio in the United States. In contrast, Scandinavia, the Canadian Shield, the Rocky Mountains, New England, the Appalachians, and the Adrondacks, are regions with low buffering capability, having highly silicious bedrock such as granite, gneises, quartizite, and quartz sandstone and are being adversely affected by acid precipitation. Freshwater lakes in these regions have been found to have a pH below 5.0.

Acidification of lakes and streams is not of interest merely as isolated phenomenon or water quality parameters. Ultimately shifts in pH levels dramatically impact the biological component of the terrestrial and aquatic ecosystems. In Norway, 741 out of 2083 lakes surveyed were reported fishless. Spring rains and run-off due to snow melt can produce sudden large fish kills. More commonly, evidence seems to suggest that fish reproduction is affected. In the La Cloche Mountain regions in Canada, female fish produced ova, but failed to release them. Primary game fish such as walleye, lake trout, and smallmouth bass are apparently less tolerant than other species. The U.S. Environmental Protection Agency has recommended that for overall fish protection, a pH of 6.5-8.5 be maintained permitting no greater change than 0.5 pH unit above the estimated natural season maximum nor below the estimated natural season minimum.

Acidic rainfall may cause release and mobilization of heavy metals such as cadmium, nickel, lead, manganese, aluminum, and mercury bound to colloidal soil particles in the soil and subsequent entry into aquatic ecosystems. Acid water may cause copper water pipes to release toxic copper into domestic water taps. Thus, water may become lethal at high pH.

While fish present more startling and obvious impacts when killed by acid rain pH shifts, effects upon microorganisms responsible for decomposition, nutrient turnover, and biogeochemical cycles are equally important. Soil respiration, an index of overall soil microbial biochemical activity is decreased at pH of 2. Decompositon of leaf litter decreases at a pH of 5.2. Subprocesses of the nitrogen cycles decrease in simulated acid rain studies at pH of 3.1. Preliminary studies indicate widely varied potential impacts upon egg hatching in the terrestrial salamander Amylostome maculatum, and a possible shift in blood calcium levels impacting antler and body growth in deer browsing on plants exposed to acid pH. Recently, growing concern has been generated from impacts of acid rain upon agricultural crops, and forest species, including such phenomena as reduced seed germination, damage to chloroplasts and surrounding cells, decrease in successful seed establishment, interference of photosynthesis, lowered resistance to disease, lesions on leaves, erosion of leaf cuticle, and needle stunting on coniferous plants. Most susceptible species include white pine, red spruce, hemlock, jackpine, trembling aspen, and white birch.

Acid rain may lead to ten to twenty percent reduction in forest productivity. Alpine regions and western slopes of New England and the Adirondack Mountains in the face of prevailing winds from the Southwest dramatically illustrate such impacts. Potential reduction in food crop yields now occur from repeated "burning" or lesions and leeching of nutrients from soybeans, bushbeans, alfalfa, cotton, barley, and fruit trees.

Limited baseline rainfall pH data has been available in the United States and are at best sketchy. The earliest known precipitation was in Brooklin, Maine on August 22, 1939, which measured 5.9, and on Camel's Hump Mountain, Vermont.

In view of the growing interest in acid rain and the fact that twelve potential sources of baseline data proved inadequate, an independent undergraduate monitoring program was initiated at the Raymond Walters College of the University of Cincinnati to establish baseline data in Southwestern Ohio. This project involved literature search and active research, revealing that although surface water is probably not significantly affected due to natural buffering capacity, increasing SO_x and NO_x, air load has caused definitive shifts in pH of rainwater over the last 25 years. Preliminary to this survey, it was hypothesized that prevailing winds carried acid rain precursers out of the Cincinnati area.

Examination of isopleths of data obtained from Southwest Ohio Air Pollution Control Division indicated that rainfall pH estimates for 1955-56 would have fallen at 5.0, for 1965-66, 4.6, and for 1972-73 at 4.3-4.4. In addition, pH, SO_2, NO_2, and NO data for 1975-1978 was obtained from the same source. This data indicated that pH reached a low of 4.2 in 1977. During the same period the SO_2 level was very high (.20 ppm). A major shift by industry from oil to coal had occurred following the 1973 Arab oil embargo. Calculation of correlation coefficients between pH and SO_2 (ppm) was 0.9368, indicating high positive correlation. Correlation between NO and pH was 0.5669; between NO_2 and pH was negligible (0.0005). Acid precipitation would seem, in this case, to be due to levels of SO_x and to a lesser degree NO. Since Cincinnati is both a major urban area and major SO_x emitter, a major portion of these materials are deposited locally as acid precipitation.

A second phase of this study involved monitoring stations. At station one, (20 miles north of Cincinnati) of fourteen values, the range was 4.0 -4.8 with main of 4.2. This value is 25 times more acidic than that of pure rainfall, of 5.6 and 6.3 times more acidic than 1955-56 estimates. Two measurements in the southeast produced a main value of 5.0. Sampling at a western monitoring station produced a mean of 4.2.

Analysis of pH data on the Ohio River and Great Miami River tributary did not show any changes which could be construed as contributed by acid rain. Surface waters are subject to great variation from point source pollution. More reliable data was sought from streams, lakes, or ponds. The only lake on which any previously measurable data could be obtained in this area was Winton Forest Mill Creek Lake. On April 24, 1978, a pH measurement at surface by Ohio EPA computer printout survey was 8.4. A July 25, 1978 measurement at surface was 8.0. On June 17, 1981, pH reading was 7.44, or five times more acidic than that of 8.4. However, too few samples were taken and no baseline data was available from U.S. Army Corps of Engineers who established the lake thirty years prior. Seasonal pH fluctuations had also not been recorded.

Acid precipitation is a reality in the greater Cincinnati region with apparent correlation between levels of sulfur dioxide, and to a lesser extent, nitrogen oxide, and pH. The gases are apparently carried as a gradient from southwest to northwest in the prevailing wind. Cincinnati lies within a region of low sensitivity to acid rain impact upon surface water due to naturally occurring geological formations. However, additional studies involving impact upon biological components of the ecosystem are warranted. Accumulation of baseline data which forms a necessary component of future studies provides a vehicle for involving undergraduates in the technical and policy components of a pressing contemporary environmental problem.

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Paper Number 52

Sharma, S.K. and J.M. Dave. "A Brief Review of the Ecological and Environmental Impacts of Technological Developments in India." Lady Irwin College, New Delhi; School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, India.

India is the seventh largest country in the world. Its area is 3,287,782 sq. kms. and its population is about 660 million with a density of 220 per sq. km. More than 15 percent of the world's population is accommodated in 2 percent of the world's land area. The total population of the country has doubled during the last forty years due, primarily, to better medical technology. After independence in 1947, the national development plans have mainly centered on strategies for rapid development in agriculture, energy, mining, transportation, and communications; relying mainly on technology advancement and application. About 75 percent of the population depends on agriculture for its livelihood. Due to the technological inputs from intensive farming, such as irrigation, fertilizers, pesticides, and high yielding varieties, total production of grains have increased from 18 to 133 million tons in the last decade.

This technological development coupled with the population explosion and urbanization has affected the environment. The centralization of industry, commerce, and employment in the urban areas has promoted population growth with the migrants coming from rural and small town areas. India's urban population has doubled during the last twenty years. The migrant population in large cities (with a population of one million and above) ranges from 49 to 65 percent and this has serious social, economic, and ecological implications. The urban ecology has been upset due to over-crowding; uncontrolled, unplanned growth; lack of resources and basic facilities of clean water, air, sewage, and waste disposal; vehicular density; and polluting industries. Urban populations in India generate about 23 million tons of solid waste per year while rural populations yield 36.5 million tons every year. Mining of just coal and lignite adds another 36 million tons of ash every year.

The effects of this technological development that have led to India's ecological and environmental problems can be studied along three broad frontiers: atmospheric, lithospheric, and hydrospheric.

The major sources of air pollution in Indian cities are the industries, domestic burning of low grade fuels, automobiles with improper combustion, and power plants. The coal used in thermal power plants in India is generally inferior with between a 15 to 45 percent ash content. When the planned thermal power stations are commissioned, the emission of sulphur dioxide alone is likely to be about one million tons per year. For non-commercial fuels, cities and villages use firewood (65%), cowdung (20%), and agricultural wastes (15%). Pollutants are being added to the atmosphere by nearly four million transport vehicles, of which 75 to 80 percent are more than ten years old and are poorly maintained. These also cause noise, vibration, traffic jams, and accidents.

There are 14 major rivers in India whose drainage basins cover 83 percent of the country. About 80 percent of the population resides in these basins. Industrial effluents, agricultural, and community wastes are the major water pollutants. Out of 3,245 towns (1981 Census), nearly 94 percent do not have sewage facilities. In the metropolitan cities, 44 percent of the population is unsewered, 65 percent of the waste water is collected and 57 percent is treated. Rivers, lakes, and coastal regions are being used as sewers. The result is that 70 percent of all the available water in India is polluted. Two-thirds of all illnesses in India are related to water-borne diseases, such as typhoid, infectious hepatitis, cholera, diarrhea , and dysentery, causing an annual loss of about Rs.6 million. The coliform count per 100 ml. in the Yamuna River before it enters Delhi is 7500 and after it receives Delhi's 17 waste-water drains, it becomes 24 million! An estimated 359 of 3329 industrial facilities in Delhi generte liquid waste. The industries are: textile dyeing, finishing, and drycleaning; chemical industries including fertilizers and pesticides; engineering industries including printing and electroplating; and other miscellaneous industries like soap, food products, rubber, plastics, etc. These industries with an effluent flow KLD of 22,854, exert a daily pollution load of 7,452 kg. BOD, 21,159 kg. TDS, and 1,585 Kg. oil and grease. The effluents released by DDT, plastic, and chemical industries is so poisonous that it needs to be diluted more than 8000 times to neutralize the harmful effects.

The impact of technology, through developmental activities such as railroad and road building, deforestation, mining, quarrying, developing new croplands, urbanization, and other construction activities is amply illustrated by the increase in deserts, soil erosion, floods, and siltation. India is loosing about 1.5 hectares of forest land every year from these activities. Today the desert covers an area of about 38.74 million hectares. India loses about 8.4 million tons of NPK due to soil erosion, worth more than Rs.7 billion. This is more than the value of all fertilizers used in agricultural production programs. Added to these are losses due to floods (Rs.10 billion per year judged from recent annual losses). Erosion is having a long range effect on flora and fauna and surface and subsurface riparian habitats.

Due to excessive irrigation and seepage below dams, an estimated 6 million hectares of land is subject to water logging. Serious micronutrient deficiencies have been recorded in areas which have been extensively irrigated and intensively farmed for high yields. In the country as a whole, 47 percent of the soil has become deficient in zinc, 5 percent in manganese, and 11 percent in iron. The total estimated affected area due to salinity, alkalinity, and water logging is 7 million hectares. A major portion of the salt-affected lands lie in the otherwise fertile Indo-Gangetic plains. One of the major causes of the increasing soil salinization problem is water logging and irrigation with brackish water.

Measures to control India's ecological and environmental problems are difficult due to the complexity of the situation. The first step is to restrict population growth and rapid urbanization. Areas where technological development has led to deterioration of the environment should be clearly identified and periodically monitored. Education of the masses; the setting up of a central environmental protection agency; zoning of industries; establishing environmental quality standards; developing tax incentives for pollution control measures; waste recycling; and above all proper landscape planning are some of the other measures government should consider.

Paper Number 53

Sia, Archibald P., H.R. Hungerford, and A.N. Tomera. "An Analysis of Selected Predictors of Overt Environmental Behavior: A Preliminary Study." Department of Curriculum, Instruction, and Media, Southern Illinois University, Carbondale, Illinois 62901.

1. Purpose

This research attempted to incorporate a set of variables which separate studies have noted to have predictive power into a single investigation in order to ascertain their relative strength in predicting pro-environmental behavior. These predictor variables were: (1) level of environmental sensitivity, (2) and (3) perceived individual and group locus of control, (4) and (5) perceived knowledge and skill in using environmental action strategies, (6) psychological sex role classification, (7) and (8) belief in/attitude toward pollution and technology. Taking these variables together, the most parsimonious set of variables which best predicts environmental behavior were identified.

2. Instrumentation

A 16-paged instrument was used, consisting of seven sections, namely: (1) demographic data, (2) behavior inventory of environmental action [BIEA], (3) level of environmental sensitivity [LES], (4) environmental action: knowledge and skill levels [EAKS], (5) individual [ILOC] and group [GLOC] locus of control, (6) personal attributes questionnaire [PAQ] which was used to measure psychological sex role classification, and (7) pollution and technology questionnaire [OT)].

The demographic data section provided information, e.g., gender, age range, educational level that helped to describe the samples. The BIEA assessed environmental actions taken by the respondents during the past year, under each of five action categories, namely consumerism, physical intervention (ecomanagement), persuasion, legal action, and political action. A behavior score, generated from the BIEA, served as the criterion variable.

Sections three to seven of the instrument provided information on the eight predictor variables utilized in the study.

The LES provided an environmental sensitivity score based on those variables identified in Peterson's (1982) study. The EAKS assessed respondents' perceived knowledge of and skill in using environmental action strategies. Respondents were assessed regarding their perceived ability to influence the solution of environmental problems/issues, either as a perceived ability to influence the solution of environmental problems/issues, as an individual (ILOC) or working with a group (GLOC). The PAQ provided data in categorizing respondents into four psychological sex role classifications, namely androgynous, cross-typed, traditional sex role, and undifferentiated. The PTQ assessed in a semantic differential format respondents' beliefs in/attitudes towards pollution and technology.

Content validity of sections two to five and section seven were established by a panel of five science/environmental educators. Spense, Helmreich, and Stapp (1974) established the construct validity and reliability coefficients of the PAQ.

Using university students in a pilot study, the following test-retest reliabilities were obtained in this study for the remaining sections of the instrument: (1) BIEA, r = 0.74, (2) LES, r = 0.537, (3) EAKS, r = 0.667 for perceived knowledge and 0.538 for perceived skill, (4) ILOC, r = 0.449, and (5) GLOC, r = 0.804.

3. Samples

The instrument was administered to two distinct samples of convenience. The first sample was composed of Sierra Club members (SC) from the States of Illinois and Wisconsin. The SC sample responded by mail. The second sample was composed of Elderhostel participants (EH) who were participating in workshops at the Touch of Nature Environmental Center, Southern Illinois University. The EH sample responded to the instrument while in workshop attendance. The combined response rate for both samples was 37 percent. One-hundred and fifty (150) usable instruments were collected (SC = 105; EH = 45).

4. Methods of Data Analysis

Instrument data were analyzed by (1) tabulating means, standard deviations, and intercorrelations among the demographic, criterion, and predictor variables, (2) classifying total behavior scores to establish low, medium, and high scorers among all respondents (regardless of sample membership), (3) ANOVA and regression analysis to determine significant differences between high and low scores and between the SC and EH samples on their behavior and predictor variable scores, (4) multiple regression analysis to determine zero and first-order semi-partial contributions of the eight predictor variables to the dependent variable - environmental behavior, (5) determining intercorrelations between dependent and predictor variables, and (6) stepwise regression (MAXR) to identify the most significant predictors of pro-environmental behavior for the total sample as well as for SC and EH memberships taken separately. Significant level was set at .05.

5. Results

Analysis of demographic data indicated that the SC and EH members differed in average age range (35 to 45 years and 55 to over 60 years respectively), average number of children (1 SC; 2 EH), average number of courses taken of conservation/environmental concerns (2 SC; 0 EH), average membership in environmental organizations (2 SC; 1 EH), average number of environmental publications subscribe to/read (2 SC; 1 EH), and perceived level of environmental sensitivity (7.5 SC; 6.9 EH on a scale of 9). The samples were similar in two respects: (1) both were college graduates and (2) both spent most of their youth in a medium-sized community of 10,000 to 50,000 people.

Regression analysis showed significant differences between SC and EH samples on their behavior scores ($X = 37.44$, F 4.145 = 3.75, $p<0.00$), with the former displaying more environmental actions than the latter.

When the entire set of respondents were classified into low, medium, and high behavior groups on the basis of their environmental behavior scores, the following action subgroups resulted: (1) low = 49 respondents with behavior scores ranging from 3-22, (2) medium = 52 respondents with scores ranging from 23-44, and (3) high = 49 respondents with scores ranging from 45-117.

The results of the analysis of variance of the differences between high and low action groups on the eight predictor variables showed that the high and low groups differed significantly on four predictor variables, namely perceived knowledge of and skill in environmental action strategies, level of environmental sensibitity and perceived group locus of control.

The environmental behavior scores of all samples were used for regression analysis to determine the relative contribution of the predictor variables. Results of the multiple regression analysis indicated statistically significant zero-order contributions by all eight predictor variables in the following order: (1) Perceived skill, F = 118.25, (2) LES, F = 101.98, (3) Percieved knowledge, F = 97.75, (4) ILOC, F = 38.99, (5) GLOC, F = 38.63, (6) Pollution, F = 23.40, (7) PAQ, F = 9.54, and (8) Technology, F = 4.50

However, when the first-order semi-partial contribution of each of the predictor variables was examined in a multiple regression analysis using all samples, only three predictor variables were significant: (1) perceived skill, F = 10.60, $p \leq .001$, (2) level of environmental sensitivity, F = 29.80, $\leq .001$, and (3) belief in/attitude towards technology, F = 469, $p \leq .03$. It seems that when given information on the effects of other predictor variables on behavior, the effect of a particular variable being observed diminished or even totally became insignificant.

Strong correlations existed between behavior (the criterion) and the predictors such as (1) perceived skill in environmental action strategies, r = 0.62, (2) environmental sensitivity, r = 0.57, and (3) perceived knowledge of environmental action strategies, r = 0.56. Also strong correlations existed betwen the predictor variables: (1) perceived skill and knowledge, r = 0.76, (2) perceived skill and ILOC, r = 0.42, (3) perceived skill and GLOC, r = 0.41, (4) ILOC and GLOC, r = 0.47, (5) LES and perceived skill, r = 0.38, (6) LES and perceived knowledge, r = 0.35, (7) LES and PAQ, r = 0.36, (8) LES and pollution, r = 0.33, (9) perceived skill and PAQ, r = 0.23, and (10) GLOC and pollution, r = 0.27.

When the eight predictor variables were analyzed using MAXR stepwise regression analysis, results indicated that the strongest predictors of pro-environmental behavior are (1) perceived skill in the use of environmental actions strategies $F_{1,148} = 89.78$, $p<0.00$) which accounted for 38 percent of the total variance and (2) level of environmental sensitivity ($F_{1,148} = 28.92$, $p<0.00$) which accounted for 13 percent of the total variance. Also, these two predictors were consistantly the most powerful for the SC and EH samples.

6. Concluding Statements

On the basis of the data analysis, it can be concluded that perceived skill in using environmental actions strategies and level of environmental sensitivity are the best predictors of environmental action. Their combined effects account for 41 percent of the total variance in the criterion variable.

The above conclusion holds a definite implication for the field of environmental education. If environmental educators are to accept the charge that the goal of the field is to produce an environmentally active citizenry, then they must go beyond educational efforts aimed at the knowledge (awareness) level and focus on the development of strategies to teach environmental action skills. Further, environmental educators must consider the variables which foster environmental sensitivity and determine ways to heighten that sensitivity in students of all ages in both formal and non-formal educational settings.

In as much as this study has not fully uncovered all the variables that account for pro-environmental behavior, as evidenced by the presence of unexplained variance, further research is recommended.

Paper Number 54

Simmons, Deborah A. "Gaining Citizen Input: Enhancing Effective Communication With the Use of National Park Planning Workbooks." School of Natural Resources, University of Michigan, Ann Arbor, Michigan 48109.

The study examined the effect of the way information was presented on the participants' ability to utilize that information, their comprehension of the issues, and their satisfaction with the participation process. The results of the study suggest that the degree to which the presentation was understandable (i.e., the useability of the information and its appropriateness for the task at hand), made the information interesting (encouraged further participation through the use of writing style, color, graphics, etc.), and provided a structure that facilitated orientation and in-depth review effected the three dependent variables: comprehension, satisfaction, and information-utilization.

Paper Number 55

Singh, Ram Babu. "Ecological Implications of Energy Technology in Indian Rural Society." Department of Geography, Banaras Hindu University, Varanasi, India.

Geographers have for some time been very concerned with man-environment relationships. More recently, a key focus of attention has been energy conservation and environmental management. This study assesses the pattern of energy utilization, the constraints of existing energy programs, the potential for energy conservation, and the significance of energy for rural development. Although electricity plays the dominant role as a source of commercial energy, in rural areas (with 76 percent of the Indian population) fuels such as firewood, animal dung, and agrowastes are also important. Some key rural energy programs like rural electrification (REC), gobar-gas, social forestry (SEP), solar and wind energy have been recently developed widely in India.

Under the REC program, villages are being electrified at a rapid rate. However, these electric systems are limited because, in some cases, electric lines pass through villages without any interconnections, and in other cases the lines are built only up to the village limits. Despite the high efficiency of solar energy and bio-gas plants for cooking, these systems have not readily been accepted by rural inhabitants. Fuel wood plantations are highly labor-intensive and lack protection. The plants were frequently destroyed by animals and the lack of water. Several wind mills are not generating energy due to inappropriate and unsuitable wind conditions. Thus, considerable work needs to be done to achieve technical feasibility, acceptability, and popularization of these programs. Therefore, the strategy of renewable energy planning and conservation should be carefully coordinated with existing infrastructural and institutional systems, socio-economic, and cultural milieu.

Paper Number 56

Sinha, Uma and M.Y.H. Hakim. "Environmental Education in the Era of Science and Technology." Department of Zoology, Samastipur College, Samastipur (Bihar), India.

"Necessity is the mother of invention." The availability of an environmental education to all people is a "must." This is especially true in the situation created by modern technology. People in the developed countries are aware of the danger of environmental pollution. In developed countries serious pollution problems already exist and therefore citizens are very cautious and anxious. In the developing countries, people have not experienced serious industrial pollution and therefore are relatively unaware and unconcerned. No country can save the biosphere alone. Any ecological imbalance in one part of the world will surely affect the other parts. Therefore for the survival of the human race, every country has to protect the environment from further deterioration. One has to evolve a middle path for modern technology which allows development, affluence, and prosperity without damage to the environment. All Homo sapiens should break the barriers of nationality, race, color, and religion and consider the human race as a single family to nurture the philosophy of "live and let others live." The highly industrialized nations of the world could even use industrial pollution as a weapon against neighboring countries. The remedy of the malady created by scientists, technologists, and industrialists lies with them, i.e., the invention of new technology for the recycling of the waste. There is cash in trash. One person's waste is another person's resource. It is suggested that:

(a) Affluent countries should generously assist the developing and poor countries in environmental education.
(b) Measures be taken to assure that no industry is established without waste recycling or treatment in any country of the world.
(c) If one material or chemical has been banned in one country due to a hazard (e.g., D.D.T.) it should be banned for all countries.
(d) Major problems of the developing countries are the same (i) Population, (ii) Poverty, (iii) Pollution, (iv) Pesticides, (v) Planners, (vi) and some of the Politicians.

Other alternative measures and a holistic approach to problem solving are also suggested.

Paper Number 57

Sivek, Daniel J., M.T. Harrington, M. Squillo, G.R. Cullen, H.R. Hungerford, and A.N. Tomera. "An Analysis of Environmental Perceptions and Behaviors of Four Discrete Populations." Southern Illinois University, Carbondale, Illinois 62901.

1. Introduction

The purpose of this study was to describe selected environmental perceptions and behaviors of groups having particular educational and experiential characteristics.

2. The Subjects:

(1) Sixty-eight (68) Southern Illinois University - Carbondale (SIU-C) students enrolled in a freshman level environmental problems course (EPC), (2) 67 Illinois Soil and Water Conservation District (SWCD) directors, (3) 97 Cooperative Wildlife Research Unit (CWRU) members from 9 CWRU's across the United States, and (4) 163 individuals attending one of seven Touch of Nature (SIU-C) Elderhostel (EDHL) Environmental Programs.

3. The Research Design:

A written survey was administered to all subjects. The survey consisted of items assessing environmental issues perceived as most important to mankind and environmental issues of greatest personal interest. Another assessment compared several variables across issues of greatest interest and a control issue. These variables were perceived levels of: (1) issue knowledge, (2) issue importance, (3) individual locus of control, (4) group locus of control, and (5) self-reported environmental behavior. A t -test was conducted for each of these five comparisons with the alpha level set at .01. Data were compared with earlier data obtained by Hungerford and Rubba (1981).

4. The Results

It was found that the CWRU and EDHL groups perceived over-population as the most important environmental issue, while the SWCD sample chose production of food, and the EPC sample chose nuclear waste disposal. The CWRU and SWCD samples' perceptions of issues of greatest importance were relatively homogeneous while the EPC and EDHL samples' perceptions were relatively heterogeneous. Statistically significant differences between issues of greatest interest and the control issue were found in all groups for perceived levels of issue knowledge, issue importance, and self-reported environmental behavior. Statistically significant differences were also found for individual and group loci of control in the CWRU, SWCD, and EDHL samples. In each comparison the variable level was higher regarding the issue of greatest interest than for the control issue.

It was concluded that (1) nonenvironmentally-allied groups' (e.g., EDHL, EPC) environmental perceptions are heterogeneous, (2) environmentally-allied academically-oriented groups' (e.g., CWRU) environmental perceptions are homogeneous and similar between groups, and (3) environmentally-allied nonacademically oriented groups' (e.g., SWCD) environmental perceptions are homogeneous and not similar between groups. It was also concluded that interest in an environmental issue was associated with higher perceived levels of: issue knowledge, issue importance, individual locus of control, group locus of control, and self-reported environmental behavior.

The researchers recommended that environmental education efforts at all educational levels be increased and/or improved and that environmental educators focus their interest on fewer and more crucial issues.

Research recommendations included: (1) Assessments should be made of environmental perceptions and behaviors of groups not similar to those studied herein, (2) Assessments should be made to determine the contributions to behavior made by variables measured in the present study, and (3) an attempt should be made to measure the extent to which locus of control perceptions are transferred from one issue to another.

References:

Hungerford, H.R. and P.A. Rubba. 1981. "A Comparison of Four Groups on Perceptions of Environmental Issue Importance." Current Issues in Environmental Education and Environmental Studies, (Vol. III). Columbus, Ohio, The Ohio State University.

Paper Number 58

Stopp, G. Harry, Jr. "Acid Rain and Agriculture: Immediate and Long Range Effects." Director, Office of Sponsored Programs, The University of North Carolina at Greensboro, Greensboro, North Carolina 27412.

Acid Rain, more precisely acidified precipitation, is a national and international environmental problem with increasingly complex and threatening implications. Acidified precipitation is caused by emissions of SOx and NOx from fossil fuel combustion by automobiles, utilities, and industry which react with moisture in the atmosphere to form sulfuric and nitric acid which are then incorporated into the natural cycle of precipitation. As a result of this process, the average pH of precipitation in the eastern United States fell from a normal value of 5.7 to an acidic 4.2 by 1975.

National concern for the effects of acidified precipitation has grown as studies in Canada and upstate New York in the 1970s indicated that normally pristine lakes and streams were being "killed" by significant drops in pH. Research into the impact of acidified precipitation on water resources has spurred interest in other segments of the natural resource base and we are beginning to see studies reported which focus on forests, wildlife, and some sectors of agriculture.

Research on the effects of acidified precipitation on crops and agricultural activities has only begun but the results of that research indicate that the potential damage to agriculture by acid rain may be widespread and quite significant. In the case of effects on the soil, the damage may be of considerable duration also.

Acidified precipitation affects agriculture dirctly, through foliar damage to crops, and indirectly, by lowering the pH of the soil which in turn can damage crop plants. More specifically these effects include:

1. Calcium, an important buffering agent in the soil, is leached out by flowthrough of acidified water. The rate of leaching increases with continued pH drops.

2. The rate of mineralization of organic litter and humus is retarded by low pH precipitation with a resultant decrease in the natural fertility of soil.

3. The introduction of acidified precipitation (pH 3.5 in experiments) inhibits the ability of Rhizobium bacteria to fix nodules on the roots of soybean plants. These bacteria fix atmospheric nitrogen into a usable form and reduce or eradicate the need for artificial nitrogen when growing soybeans or other legumes and the ability to host nitrogen-fixing bacteria has been an important factor in the economic success of soybean agriculture in the United States.

4. Leaf surfaces can have significant amounts of cuticular wax eroded by acidified precipitation. In experiments with kidney beans, the erosion of this natural layer of protection resulted in increased levels of halo blight and certain bean rusts, both of which reduce agricultural productivity.

The implications of these reported results are potentially quite negatively significant for agricultural productivity in this country. Soybeans are one of the major cash crops in the United States and soybean products are staples for much of the world. If damage to the soybean crop in the United States, the leading producer in the world, is long term, the results could be catastrophic in economic and human terms. The implications for legumes of all kinds, which are grown both as green manure and as a real crop, could be very costly, especially if the soil pH is changed permanently. The damage to plant foliage may spread to foliage plants whose appearance is critical to their marketability; lettuce, cabbage, celery, and tobacco farmers may see reduced market prices for acid rain damaged crops. Similar damage to fruits and vegetables may result in negative economic impacts.

Overall, it appears that acidified precipitation poses a very real threat to food production and the economic health of American agriculture. This threat may be alleviated by rapidly reducing the levels of air pollution which are lowering the pH of the atmosphere. If the effects are incorporated into the soil regime, they may be much more long-lasting, much more difficult to reverse, and of much more economic and social significance than have been any of the other effects of acidified precipitation in this country.

Paper Number 59

Stubbs, Harriett. "What Do Teachers Want In Order to Teach About A Current Environmental Issue: Acid Rain?" The Acid Rain Foundation, Inc., St. Paul, Minnesota 55118.

1. The Importance of This Environmental Topic

Acid rain is not a new problem. It was first described in England in the 1850's as a result of air pollution (Smith, 1982). Considerable research on the topic has occurred since that time. For instance, Scandinavian researchers have been monitoring and recording information on acid precipitation since the 1950's (Cowling, 1980; Gorham, 1981). In this country, knowledge of acid rain and its effects has expanded over the past ten years (Likens, et.al., 1979). However, scientific research efforts were not matched by secondary education. The question is "Why."

Galloway, et.al., (1978) stated unequivocally that acid precipitation was one of two major environmental problems in the United States. President Carter in August 1979, allocated ten million dollars per year for ten years for interagency research on the problem. Yet, a search of the environmental and science education literature, as well as discussions with scientists and science consultants in State Departments of Education across the country, revealed no mention of the development of acid rain curriculum prior to 1979.

Educators should consider the incorporation of current environmental problems in science, social studies, and environmental studies. In addition, the causes, effects, implications, and possible solutions of these problems must be considered in order to attain a more educated populace that can make better policy decisions.

Bigeleisen (1981) suggested that in the 60's the environmental movement addressed the cause, effect, and remedies of many different problems. He stated, however, that:

> We may find these concerns were simple; we now confront qualitatively different concerns which already are testing both our science and our making of public policies. Instead of being local, they are global; instead of being susceptible to local or national solutions, they demand international collaboration; instead of being obvious, the problems are subtle, intricate and unprovable; instead of cause quickly leading to effect, the two are separated by decades, the putative consequences becoming apparent after their causes are gone.

In the 1970's acid rain emerged as a major environmental issue. The global nature of this problem was reflected in the 1982 Stockholm Conference on the Acidification of the Environment. The conference was held to highlight the problems and to celebrate the 10th anniversary of the UN Conference on the Human Environment.

In the fall of 1981, a survey of 871 science teachers in the State of Minnesota was made. Part of the survey involved questions dealing with the introduction of acid rain into the classroom and the use of materials relating to acid rain. Replies were received from 593 secondary science teachers (physics teachers were not surveyed because there was no component part of the curriculum developed for physics).

The responses to question #40, "Have you introduced the topic of acid rain in your classroom?" were important in this study, because it was this question which divided the science teacher population into user and non-user groups. Only 559 responses were tallied since only those respondents who answered both questions #40 and #41 were considered in the following statistical analysis. Of the 559 respondents, 435 or (77.8%) answered "yes, they had introduced the topic of acid rain into their classroom;" 124 or (22.2%) replied "No, they had not."

The same 559 respondents answered question $41: "How likely are you to discuss acid rain this school year?" Almost 90 percent, or 487 responded "I will;" 72 or (12.9%) responded "I will not." From the 435 who answered "yes" they had introduced the topic this year, 487 or about 11 percent more will teach the topic next year. Of the 124 teachers last year who did not introduce the topic, 57 are still not going to, but 67 will teach about acid rain. Therefore, according to this self-reporting data, more than half of this group of teachers will introduce acid rain into their curriculum. However, 10.2 percent had not and will not introduce the topic. It would be informative to survey these teachers to determine what variables are unique in this group.

3. What Teaching Materials Do Teachers Use To Teach About A New Topic

In 1981, 593 Minnesota science teachers indicated by rank order that they needed: a 16 mm film, an information packet, reading with questions, and laboratory activities, to teach about acid rain. Will these same selections of materials apply to other curricular areas which are new and could be placed in the classroom? Further research on other topics needs to be followed, for this would be important: to the curriculum developer who needs to know where time and money should be spent; to the teacher who needs current information in order to give instruction to classes; and to the student who needs objective information about current environmental issues.

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Paper Number 60

Swanson, R.A., A. Wood, and R. Lockett. "The Environmental History Cluster at Union College." Environmental Studies Program, Union College, Barbourville, Kentucky 40906.

As part of its general studies requirements, Union college has introduced the concept of the "cluster" -- separate courses having in common a theme, class sessions, and readings. The purpose of the cluster is to show the interdisciplinary nature of problems in today's society. The latest cluster, which will be offered during the Fall 1983 semester, considers moral and ethical choices from the perspective of literature, environmental studies, and political science.

ENGL 381 - In Search of Paradise -- examines how a literary tradition works by tracing one theme (the vision of paradise) through the centuries and explores the relationship between literature and the society from which it comes. This type of relationship is also examined in ENVS 381 -- Environmentalism: Ethical and Historical Dimensions -- which deals with the evolution of environmental ethics within a societal context. PLSC -- Moral Reasoning in Political Theory -- examines ethical judgments in decision-making as found in the writings of western political theorists. Readings for all three courses will be chosen from selections such as Robert Heilbroner's Inquiry into the Human Prospect, Loren Eisley's Darwin's Century, Thoreau's Walden, and Huxley's Brave New World.

Paper Number 61

Szuhy, Donna L.T. "Generating Creativity Through the Imagination." Supervisor, Education Section, Ohio Department of Natural Resources, Columbus, Ohio 43224.

This session is a practical hands-on approach in developing activities for all learning styles. This is a how-to, make it, take-with program.

AUDIO LEARNING - Two pre-recorded fantasies will be used to illustrate how educators can stimulate mental pictures of the natural world. Participants will write and share a no-cost field trip to a nature center, natural area, or historic site.

VISUAL LEARNER - Visualization is considered "the other side of reading." Focus will be on observation and expressing mental images through visual self-expression. Participants will identify resource concepts and develop activities useful to their program.

KINISTIC LEARNING - Hand puppets have surfaced as an exciting way to deliver environmental messages to young students. This activity will help educators design puppets and write appropriate dialogue.

Paper Number 62

Tanner, Thomas. "A Bibliometric Analysis of Current Issues, 1975-1983." Department of Environmental Studies, Iowa State University, Ames, Iowa 50011.

Research is now underway similar to that applied by FORCE to the Journal of Environmental Education, and published therein in 1978. A list of most-cited publications and a list of most cited authors, excluding self-citations and editorships, is being compiled and analyzed. Discussion includes: those authors and topics most influential to Issues authors as a whole, and to different clusters, or interest groups, among Issues authors. Apparent trends over time are noted.

Paper Number 63

Tate, David. "The Problems and Process of Identity Maintenance in the Anti-Nuclear Movement in America." Social Science Department, Missouri Southern State College, Joplin, Missouri 64801.

Recent research has recognized that social movements often confront several dilemmas in attempting to mobilize the many strategies and tactics that are necessary for success. The strategic and tactical problems faced by the anti-nuclear movement in the United States have largely been emphasized in the research as four major elements: (1) the single-issue vs. multiple issue focus of the movement; (2) the definition of non-violence; (3) the intent of the civil disobedience practice by the protesters; (4) the use of affinity groups and a consensus style of decision-making (Barkam, 1979). These four dilemma areas play a significant role in the public image maintenance considerations of the movement. Any social movement must effectively confront and solve the problem of public relations in order to generate and maintain a legitimate base. Decisions by movement organizations or groups concerning specific strategies and tactics must incorporate the need for a consistent, positive public image. As Wilson (1973) states, "many social movements are often remembered more for their tactics than for their objectives." Tactics contribute significantly to the establishment of the identity of a social movement because tactics may be all that is visible in the movement. Many social movements are not much more than tactical organizations, having little substance beyond their efforts to bring a cause to the attention of society or coerce some sphere of authority to induce change. In this paper I will examine the issue of identity maintenance within the American anti-nuclear movement. Identity maintenance as an issue contains two basic areas of concern:

(1) External public relations.
(2) Internal membership identify.

Both forms of identity maintenance are closely linked to the basic movement ideology of non-violent direct action. Both are also linked to the structure of the movement organization. Non-violent direct action as an ideology is generally more palatable to the public than is overt violence and property destruction. The anti-nuclear organizers as a group have wanted to avoid the tactical-image mistakes of earier social movements, and non-violence has been their principal method of accomplishing this. The structure of the movement has primarily evolved as a symbolic link to this non-violent ideology. Consensus decision making and the use of affinity groups have projected a certain desired image to the public and also have served as integrating factors concerning movement membership. By maximizing individual participation, the movement's structure has produced a positive moral and minimized potential feelings of disenchantment with group decisions. The avoidance of group factionalism can also be an important property in promoting a positive public image.

The problem of external image maintenance is basically handled by and modified through the ideology and structure of the anti-nuclear movement. In terms of analysis, this represents an effective theoretical combination of the resource mobilization perspective (Oberschall, 1973; McCarthy and Zald, 1977; and Jenkins and Perros, 1977) and the traditional social-psychological approach on the collective behavior aspects of social movements (Smelser, 1963 and others). By theoretically combining these two perspectives, a greater understanding is generated concerning the movement dilemmas of: (1) effective use of internal resources to promote a cause, (2) the need to project a positive public image, and (3) the need to produce and maintain the psychological affinity of the membership to the movement. Identity maintenance in the anti-nuclear movement will therefore be focused within this paper on the following: non-violent direct action, use of the mass media (rhetoric and overt action), consensus decision making, and affinity groups (structure of the movement).

The above makes use of both resource mobilization and social-psychological processes. Both external identity maintenance (public relations) and internal identity maintenance (psychological affinity of members to the movement) are generated and maintained by the ideology and structure of the movement. The Sunbelt Alliance Anti-Nuclear Organization, based in Tulsa, Oklahomna, was used as a case study.

Paper Number 64

Vogl, Robert L. and Sonia W. Vogl. "Rural and Urban Interconnections." Outdoor Teacher Education, Northern Illinois University, Oregon, Illinois 61061.

This study focuses on the necessity for integrating rural and urban environmental programs. Concepts addressed include: 1) An overview of the historical roots of the urbanization of America, from early programs through environmental management programs of the past decade and a half; 2) Diverse and contradictory views of the city and urban living; 3) Biases against the city; 4) Children's Literature and the city; 5) Examination of new trends which create the possibility of increasingly decentralized living; 6) Educational programs which focus on rural and urban ecology, environments, and interrelationships; and 7) The rationale for the integration of rural and urban focuses into a unified, rational approach.

Paper Number 65

Volk, Trudi L., H.R. Hungerford, and Audrey N. Tomera. "Curriculum

Needs in Environmental Education As Perceived by Professional Environmental Educators: A Report on a National Survey." Department of Instruction and Learning, Murray State University, Murray, Kentucky 42071; Department of Curriculum, Instruction and Media, Southern Illinois University at Carbondale, Illinois 62901.

1. Introduction

In an attempt to assess curriculum needs in environmental education (EE), this study surveyed professional environmental educators (NAEE and CEA members) in the United States by mail regarding their perceptions about the desired state and the current status of EE curricula, the need for new EE curricula, the anticipated use of that curricula by practitioners, and the need for inservice teacher education relative to new EE curricula. Additional information was sought regarding the differences, if any, between formal and non-formal environmental educators with respect to the above perceptions.

Curricular needs are typically assessed relative to an authoritative set of criteria, i.e., a valid set of goal statements. This study utilized a set of fifteen goals which were adapted from the EE Curriculum. Goals developed by Hungerford, Peyton, and Wilke (1980) and which addressed ecological foundations of knowledge, the awareness of issues and human values, the investigation and evaluation of issues and solutions, and citizenship action (Volk, Hungerford and Tomera, in press). The goals correspond to the Tbilisi objectives and were validated by a jury of nationally recognized environmental educators.

The instrument developed for the study, the Environmental Education Curriculum Needs Assessment Questionnaire, contained the fifteen goal statements and posed five major questions to the respondents relative to each of the goal statements. Those five questions were:

1. To what extent is this goal important?
2. To what extent do existing curricula accomplish this goal?
3. To what extent is there need for new curricula addressing this goal?
4. To what extent would new curricula addressing this goal be used by teachers?
5. To what extent would inservice teacher education be needed for new curricula addressing this goal?

Respondents were asked to consider these questions at each of four academic levels: elementary, middle school/junior high, secondary, and college/university. The response scale ranged from 5 (A complete extent) to 1 (No extent) and included a sixth category to allow respondents to indicate an inadequate knowledge of need at a particular level.

The memberships of two professional organizations (NAEE and CEA) were identified as the desired population for this study, and a twenty percent random sample (n = 169) was drawn from their combined rosters. Ninety-nine (58.6%) of the individuals who were surveyed returned usable responses, and twenty (11.9%) incomplete or otherwise nonusable survey instruments were also returned.

The major findings are identified and discussed below, and summarized in Figure 1.

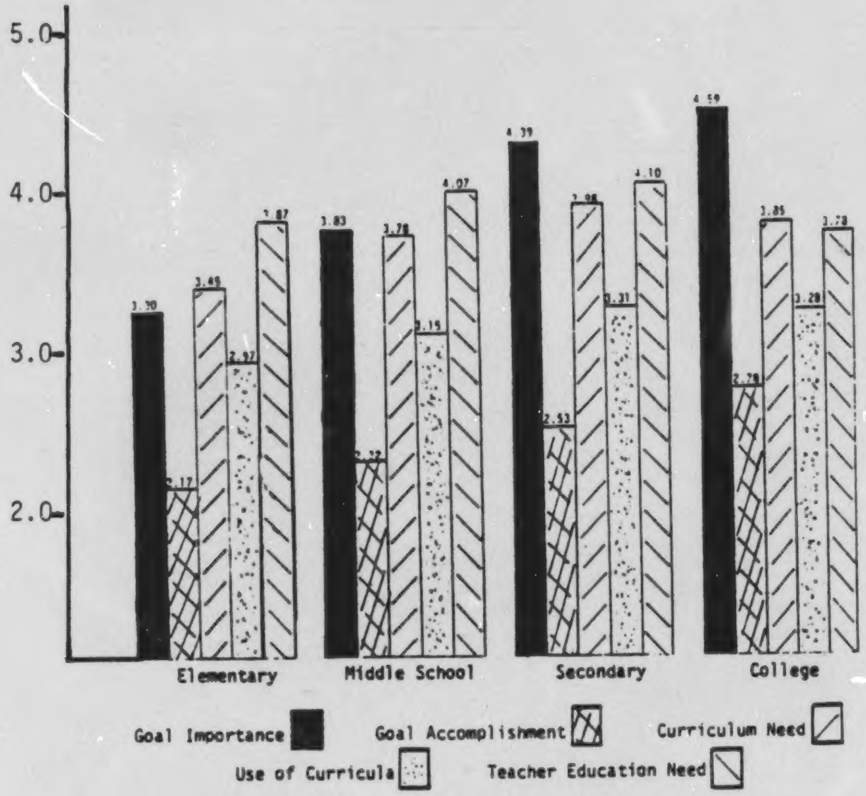

Figure 1. Weighted (in terms of the number of subjects responding to each item) grand means of the responses to each of the five major needs assessment questions portrayed at each of four academic levels (where means of 2.0 = to a very little extent, 3.0 = to a moderate extent, 4.0 = to a considerable extent, and 5.0 = to a complete extent).

2. Findings:

1. The EE goals are considered important at each academic level, and increase in importance at each succeeding one.

2. In general, professional environmental educators believe that the goals for EE are not being accomplished with existing curricula. Although perceived accomplishment of the goals increases somewhat across the academic levels, it rarely exceeds the moderate extent of accomplishment at any level. There is a somewhat greater degree of accomplishment relative to the lower level goals (ecological foundations knowledge, and awareness of issues and values) than there is relative to the higher level goals (investigation/evaluation of issues and solutions, and citizenship action).

3. At each academic level, the perceived importance of the goals exceeds their accomplishment. The difference between these two variables increase at each succeeding level.

4. There appears to be a perception of substantial need for goal-oriented curricula at each academic level. The greatest need is observed at the secondary level, followed in turn by the college, middle school, and elementary level.

5. The need for inservice teacher education is perceived to be a major need at each academic level. The greatest need is observed at the secondary level, followed in turn by the middle school, elementary, and college levels.

6. Professional environmental educators anticipate that classroom teachers would use new curricula to a moderate extent or better.

7. No substantial differences exist between the formal and non-formal environmental educators regarding the above perceptions.

3. Discussion:

The results of this study provide a persuasive argument for increasing efforts in teacher education and curriculum development in the field of EE. Needs in goal-oriented curricula and goal-oriented teacher education are perceived as extant at all academic levels and appropriate to all of the goals for EE.

Encouragingly, professional environmental educators also believe that goal-oriented curricula would be used by classroom teachers, although the extent of use of curricula relative to discrete goals would be quite varied. Since previous research has indicated that available curricula and teacher training are both factors in a teacher's use of EE materials (Johnson, 1980), it appears appropriate to suggest that if classroom teachers were provided with goal-oriented curricula and with the inservice teacher education which would permit them to utilize the curricula, their use of said curricula could be increased.

There may be cause for concern over the findings relative to goal importance. Although the EE goals are considered quite important at all academic levels and increase in importance with succeeding levels, further analysis reveals that their perceived importance remains relatively static across goal levels. That is, at a given academic level, there is no appreciable increase in perceived importance of the higher level goals in relation to the lower level goals. In fact, at most of the academic levels, there is a slight decrease in importance for the citizenship action goals. This phenomenon is somewhat distressing given the posture among leading environmental educators that the higher goal level (i.e., citizenhsip action) is the major outcome upon which EE efforts are, or should be, focused. This might suggest that by and large, environmental educators continue to act on the belief that citizenship action can be brought about through a focus on environmental knowledge and awareness, although a growing body of research (Horsley, 1977; Klingler, 1980; Ramsey, Hungerford, and Tomera, 1981) indicates otherwise.

4. Recommendations

Major recommendations which resulted from this study included immediate and extensive inservice teacher education efforts and the development of curricula which address the goals utilized in the study. Also recommended is an analysis of existing EE curricula relative to these EE goals and the subsequent revision and strengthening of that curricula.

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Paper Number 66

Wecker, Stanley C. "A Strategy for Teaching About Human Environmental Impacts in Introductory Biology and General Ecology Courses." Department of Biology, City College of New York, New York 10031.

The growth of environmental awareness in their students has motivated teachers on the college and secondary levels to discuss human environmental impacts in a variety of courses. The problem is how best to organize and present such a diverse array of topics in a limited period of time. An approach which relates environmental problems to structure and function in natural ecosystems is summarized and described.

Paper Number 67
Williams, Robert, Elizabeth Sherwood, and Robert Rockwell. "Hug a Tree: Activities for Preschool Kids in the Out-of-Doors." Department of Elementary and Early Childhood Education, Southern Illinois University at Edwardsville, Edwardsville, Illinois 62026.

This workshop is designed for those working with pre-school and primary aged children. The presenters have developed a wide range of outdoor education activities for use within the immediate school environment. The school yard is readily accessible and familiar to the children. In addition it provides many examples of how people affect the environment. The litter along the fence and the bare dirt under the climbers are obvious examples. Experiences which use the basic skills of observation, measurement, and collecting and recording data are emphasized. In the process, children are helped to reach a basic understanding of the impact people, including themselves, have on the natural world. All ideas presented involve children as active, thinking people. Problem solving and exploration are emphasized, as well as a major focus on the affective aspects of environmenbtal education. Examples of students work were presented along with some hands-on experiences. Hand-outs wereavailable to those attending the session.

Paper Number 68
Wilson, David A. and Karla Goodman. "Teaching Energy Management in the School." Missouri Botanical Garden, Education Department, St. Louis, Missouri 63166.

Rising energy costs affect us all. Although students do not generally pay energy bills, they are affected often by classrooms which are too cold or too hot, or drafty or in some other way are environmentally unsuited for comfortable learning.

According to some estimates the average cost of energy in schools has increased three times in the last decade, from $20 per child to $60 per child. These are dollars which could otherwise be spent on teachers' salaries, books, or materials. In many school districts the money leaves the school system to pay for the gas, oil or coal which heats the buildings. Using the (Figure 1) questionnaire, a teacher can take students on a tour of the school building, use the powers of observation to determine areas of energy efficiency and

Figure 1. Building Energy Survey.

Instructions: Read the statements below and check the Yes or No column in response to the appropriate questions. A checkmark in the Yes column corresponds to an energy efficient feature. When you finish each survey, examine the number of yes and no responses. Compare your 3 building surveys. What conclusions can you make about the buildings' energy efficiencies?

The name of this structure is:____

In the space below, draw an outline of the shape of the structure. Label it North, South, East and West.

	Yes	No
1. Because we live in the northern hemisphere, the sun shines on us from the south. Windows on the south side of a building allow the sun's rays to help heat it in the winter. Is there more glassed area on the south side than on the north side of this structure?		
2. Window and door overhangs shade the building from the high summer sun, yet allow the low winter sun to shine in to heat the building. Are there overhangs on the south side of this building?		
3. Landscaping affects energy conservation. Evergreen trees can protect the building from the wind, which blows mostly from the north. Are there evergreen trees on the north side?		
4. Deciduous trees shade the building in summer from the southern sun, but lose their leaves in winter, allowing the sun to thine through. Are there deciduous trees on the south side of this building?		
5. Heat energy escapes a building each time people walk in and out. Double doors help prevent heat loss. Recessed doorways protect the entry from winds. Have either of these provisions for energy conservation been made?		
6. The outer building material is made most of (circle one): glass/plexiglass, metal, concrete, brick Enter the building. Place your hand on the interior of an outside wall. Does the wall feel warm or cool? How does the temperature of the wall compare with the outside? Does the wall seem to provide some insulation?		
7. Double panes of glass help prevent heat loss. Are there storm windows?		

(Continued..)

(Figure 1. Continued).

	Yes	No
8. Closing shades or drapes at night and on cloudy days helps prevent heat loss. Opening them on sunny days allows the sun to help heat the building. Are there shades in this building?		
9. Broken or cracked panes of glass allow heat to escape. Is all the glass you see unbroken?		
10. Look for cracks and gaps in the building shell where-ever-two materials join. Put your hand up to a crack to see if you can feel cold air blowing in (infiltration). Caulking is used to seal joints where two immoveable materials join. Can you find evidence of caulking?		
11. Weatherstripping is used to seal cracks where moveable parts join. Can you find evidence of weather stripping?		
12. Open windows and doors allow heat to escape during winter months. Are all the windows and doors that you can see closed?		
13. Moveable windows, ceiling vents, and fans allow air to circulate and cool breezes to enter in the summer, reducing the need for air conditioning. Can you observe evidence of these mechanisms? Which one(s)? ________ ________________________________		
14. Thermostats control and thermometers measure the temperature of a building. Can you find one? If you can read the temperature, what is it?__________		
15. Look and listen for methods of heat distribution, such as radiators, fireplaces, fans, vents, etc. If they are not blocked, air will flow more efficiently. Are they free of obstructions?		
16. Find out what resources in the environment are being used, or have been used to provide heat for this building. (Examples: coal, sun, wood, natural gas)______________ ________________________________		
17. Observe the lighting fixtures. At one time, kerosene and candles were used instead of electricity. Natural light from the sun is the most efficient source of lighting. Does the building make use of natural lighting? Are some artificial lights turned off in the daytime?		
18. Light colored interior walls reflect light better, reducing the amount of electrical lighting needed. Are the walls light in color?		

*** developed by-
Missouri Botanical Garden
Education Department

waste, and then conduct some planning sessions which lead to student proposals for sound energy management. Some student proposals may include actions which the students can take on their own to conserve energy. Others may require approval by the school board or other officials. In the latter case, the students can prepare their proposals and make a formal presentation to the school board for the implementation of an energy management plan.

Our energy management program was developed at Missouri Botanical Garden for classes coming on field trips to learn about environmental issues. In preparing the program, we conducted some research into the history of energy costs at the Garden. The Garden was founded in 1859 by Henry Shaw, a wealthy St. Louis businessman. Checking into our records in the library archives, we discovered that in 1873, Henry Shaw spent a total of approximately $600 on energy for the buildings on the grounds of his garden. A decade later in 1883, the cost of energy for his property had increased 50 percent to $900, including a whopping $345 for 76 cords of firewood. These figures contrast dramatically with current energy costs for the Garden. In 1983, the Garden's energy costs will be approximately $415,000. In 1977, it totaled $94,000. Estimates for 1988 run to $879,000, up 100 percent in 5 years and 8 times in 10 years. These figures come from the maintenance superintendent at the Garden.

A teacher wishing to conduct an energy class at the school may be able to obtain similar records from the school building: dating back to its earliest years, continuing through the present year, and with future projections.

Using the attached questionnaire, then, students and teachers can survey the school building to determine areas of energy waste. This particular questionnaire is designed for use without any special instruments. The survey can be conducted in one class period. During the same period, in a subsequent period, a teacher may make arrangements with the school custodian for a visit to the boiler room. At this visit the students may wish to check the meters, and return subsequently on a weekly or monthly basis to observe school energy use.

In a subsequent class, the teacher can divide the students into several energy management teams. Each team can then be given ten minutes to brainstorm solutions to the various energy problems they have uncovered in the school. It is important to give the students clear rules for brainstorming. Any idea is acceptable and should be listed. No discussion of the merits of an idea should take place during a brainstorm. This is simply a time to list all possible ideas. The teacher can then give the students 15 or 20 minutes to develop a plan which may be implemented in the school. As the students begin to develop the plan, the teacher can select one student from each of the teams to serve on the "school board," which will evaluate the proposals. These students determine the various criteria by which they will judge the proposed plans. At the next class period the teams present their proposals to the "school board," which then selects the plan which it deems to be the most effective for the school.

Having completed this simulation game, the students are now ready to take their plans and re-work them again for a twofold purpose. One series of plans may be items which the classroom can implement in a school-wide campaign. With such plans, the students may wish to approach school organizations, the principal, the teachers, and finally the entire student body with suggestions for energy management.

The second set of plans will be those items which require capital investment and/or school board approval. The class can develop a presentation and select a delegation to present it at a future school board meeting. At least one class which undertook this survey last spring has made a presentation to their school board.

Paper Number 69

Wilson, R.J., H.R. Hungerford, and A.N. Tomera. "Model Salient Beliefs Toward Environmental Action Strategies of Groups Displaying Differing Levels of Action Behavior: A Pilot Study." Department of Curriculum, Instruction, and Media, Southern Illinois University at Carbondale, Illinois 62901.

1. Introduction

The deterioration of the environment has sparked considerable discussion over the quality of human life vs. the quality of the environment. Many environmentalists have called for swift and decisive environmental action by the public (Calwell, 1980 Hungerford and Peyton, 1980; and Tanner, 1980). Massive information campaigns have been launched to this end with the goal of increasing the public's knowledge. But, for the most part, they have been only moderately successful. Research in this area indicated that knowledge alone is not enough (Ramsey, 1979). To find the reason(s) behind this puzzling phenomona, some researchers have begun to investigate group environmental perception as one possible explanation (Harrington, 1982; Hungerford and Rubba, 1981; and Squillo, 1983). Data indicate that the presentation of identical information to a group will be perceived differently by the discrete individuals which comprise it (Saarinen, 1974). In addition, two groups which display different levels of enviromental action behavior may have different perceptions of the environment (Harrington, 1982; Hungerford and Rubba, 1981; Saarinen, 1974; Sivek, 1982; and Squillo, 1983). It has also been found that some groups with the same level of environmental action behavior can have different perceptions of the environment (Harrington, 1982; Hungerford and rubba, 1981; and Squillo, 1983). These findings suggest a further need to investigate the relationship between environmental perception and environmental behavior.

One possible insight into this problem might be found by the investigation of the underlying components of beliefs and values which constitute environmental perception. This type of research would provide a foundational understanding of the differences in environmental action perception. Unfortunately, to date no instruments exist which measure environmental perception associated with levels of environmental action behavior. However, Fishbein and Ajzen (1975) have proposed a Value-Expectancy Model which can provide a theoretical framework to circumvent this problem.

Fishbein and Ajzen (1975) have suggested that the way in which an individual perceives the environment is a direct function of the evalutive importance placed on a small group of beliefs which are governing the individual's behavior. These beliefs are salient of the individual. The concept of saliency can also be applied on a larger scale to groups. Here, group beliefs are normally distributed across a set of beliefs with the most frequently held beliefs being the modal salient beliefs for the group. The Value-Expectancy Model also indicates that by narrowing the focus of perception to a specific aspect of an individual's or group's total behavior, it is possible to infer a direct link between specific behavior and its salient beliefs. Thus, it should be possible to determine the salient beliefs regarding environmental action for a particular level of environmental action.

2. Purpose

The purpose of this pilot study was two fold. The first was to develop instruments which would measure the beliefs of high and low environmental behavior groups regarding categories of environmental action. The instrument development process included mechanisms to test the effectivenss of the instruments as well as the data collection methodology. The second objective was to use data from the developed instruments to gain a preliminary understanding of the number, types, and evaluative importance of the modal salient beliefs toward environmental action strategies held by two groups displaying different levels of environmental action behavior.

3. Procedure

Two groups were selected which were initially assumed to have different levels of enviromental activity, i.e., one showing high amounts of environmental action behavior and one displaying low levels of this type of activity. Both of these groups were samples of convenience. The high group was a graduate seminar on environmental issues (N=16) and the low group was an undergraduate level introduction to teaching elementary science course (N=24) at Southern Illinois University - Carbondale, Illinois.

Fishbein and Ajzen (1975) have suggested that two instruments are needed to survey the beliefs within a group. The first instrument is necessary to solicit the salient beliefs in an open-ended free response format. The subsequent instrument (created from data collected by the first instrument) is needed to measure the evaluative importance levels of those salient beliefs. They have also noted that it is important during the measurement process not to cue the individuals regarding any aspect of the beliefs being surveyed. Thus, because of the risk of cueing individuals with specific types of information contained in the behavior instrument, each group first received the Free Response Belief Inventory of Environmental Action (FRBI).

The FRBI is an open instrument designed to correspond to categories of environmental action strategies proposed by Hungerford and Peyton (1980), i.e., persuasion, consumerism, legal action, political action, and physical intervention (ecomanagement). The researchers recognized that these were not the only forms of action individuals could take to remediate an environmental issue and therefore included civil disobedience as an action category. In addition, Fishbein and Ajzen (1975), have indicated that salient beliefs can range from attributes of a belief to consequences associated with a belief. The FRBI was then expanded into an attribute section and a consequent section to accommodate this point. Thus, the FRBI allowed individuals within each group to express their own personally held salient beliefs (which could potentially be guiding their own behavior) regarding a specific category of environmental action strategies.

Upon completion of the FRBI , both groups were given the Behavior Inventory of Environmental Action: A One-Year History (BIEA). This instrument was adapted from earlier studies (Harrington, 1982; Hungerford and Rubba, 1981; Sivek,1982; and Squillo, 1983) and used as the criterion measure. It contains the five subscales which correspond to the categories of environmental action proposed by Hungerford and Peyton (1980). In addition, a civil disobedience category was developed by the researcher and added to the instrument. The scores obtained on the BIEA were used to determine an individual's degree of environmental activity. On the basis of these scores, individuals were categorized into two subgroups exhibiting specific levels of either high or low environmental activity. Arbitrary limits of 0 to 20 actions per year were used to define the low subgroup and 40 to 60 actions per year for the high subgroup. Data from individuals in any group whose scores fell outside the arbitrary levels chosen to delimit either high or low levels of environmental acitivity were not used in further steps of the study. Thus, the high action subgroup contained fourteen individuals and the low action subgroup consisted of nine individuals.

From the responses of the remaining individuals in each subgroup, the five most frequently expressed beliefs for each item on the FRBI were used to construct a specific Modal Salient Belief Inventory of Environmental Action (MSBI) instrument for each subgroup. Using a Likert format, the MSBI was used to provide an index of the strength with which each of these expressed beliefs were held within the subgroups. Also, in order to ascertain the degree of discrimination between the MSBI forms constructed for each subgroup, each subgroup received their own MSBI plus the alternative form of the MSBI of the reciprocal subgroup.

4. Data Analysis and Results

The data collected during this pilot was subjected to both quantitative and qualitative analysis. Pearson's Product Moment Correlations between the total number of responses given on the FRBI and the total scores obtained on the BIEA showed a significant correlation (r.=62). However, subscale comparisons showed a much lower range of correlations (range r=-.14 go r=.44). Independent t-test comparisons of the total number of responses expressed by the subgroups on the FRBI showed a statistically significant difference at alpha =.05 with the high subgroup expressing more beliefs. Analysis of the subscale items indicated a similar pattern with the exception of two items namely attributes of civil disobedience and consequences of persuasion. Scores on each item of the low subgroup's MSBI form were compared between subgroups. A similar analysis was made on the scores on the high subgroups MSBI form using independent t-test statistics. Relatively few belief items were found to be statistically significant at the alpha =.05 level. Eleven belief items on the high behavior's MSBI and five belief items on the low behavior's MSBI were significantly different. Further analysis using Edgington Additive Probability method showed that a sufficient number of items on both MSBI forms were different to a statistically significant degree to indicate that the instruments did have some discrimination power between subgroups. In addition, when the means were compared qualitatively, the data appeared orderly. The high behavior subgroup consistently showed a mean value higher than the mean value of the low behavior subgroup on the high behavior's MSBI (form B). The same pattern emerged on the low behavior's MSBI (form A). The low subgroup generally had a higher mean value although the pattern showed some inconsistencies.

5. Conclusions

While the potential for overlap between each of the subgroup's salient beliefs was (and is) very high, the data indicate that there were differences in the number of salient beliefs expressed. The high behavior subgroups responded with more beliefs on the FRBI in general and on must subscales. In addition there appeared to be a high correlation between the number of responses given on the FRBI and the scores obtained on the BIEA criterion measure. The modal salent beliefs expressed by each subgroup at face value appeared different. However, the number which were statistically different occurred in a frequency too high for the MSBI forms not to have some discriminative power. This potential could be seen in the orderliness which emerged within each MSBI form. It is more than probable that the lack of significant finding on the MSBI items is a function of sample size being small and being a sample of convenience.

One final note is necessary. At the conclusion of each step of the procedure participants were asked to provide verbal feedback on any aspect of the study. Consistently, the subjects remarked on their difficulty to distinguish betwen attributes and consequences. Most felt the FRBI was redundant and took too long to complete. These comments were born out when a qualitative comparison of the original FRBI responses was made. Many individuals did not distinguish between attributes and consequences. Thus, it would appear that the two parts of the FRBI could be collapsed during future use.

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Paper Number 70
Wolanin, Janet L. "Ideas on Environmental Education Program Development and Evaluation - Why, What, and How." St. Francis School, Louisville, Kentucky 40218.

1. The Problem

Approximately 75 percent of the U.S. population occupies 16 percent of the country's territory. The largest percentage of that population is concentrated in urban and suburban communities. These communities are faced with a wide range of environmental problems -- energy, transportation, housing, air, water, food, and solid waste. Although these problems are legitimate concerns of government officials, the ultimate responsibility for making decisions concerning environmental problems and individual life styles lies with the citizens. People need to be educated to understand and solve the wide spectrum of environmental problems facing them. Nature centers have long responded to this need by providing environmental education programs for school-aged youth.

One way that nature center educators can work to further the cause of environmental education is by not only providing quality environmental programs, but by also verifying their educational worth. Evaluation, the logical and systematic process of gathering and using information regarding the nature of an educational program to make value judgments concerning its worth, should permeate a program from its inception and be incorporated as an ongoing, vital part of the program development process. Properly done, evaluation can yield many benefits.

* increased responsiveness among educators to the needs of their clientele,
* the clarification of program goals and objectives,
* comprehensive program design,
* educational accountability -- to the community-at-large and especially to funding agencies, parents, teachers, and students,
* the information necessary for sound decision-making -- albeit financial, personnel, or program (e.g., the revision, expansion, or elimination of an existing program or the creation of a new one),
* the measurement of student learning,
* the basis for claiming educational benefits (e.g., increased environmental knowledge, more viable environmental attitudes, and more environmentally responsible behavior) ,
* valid and reliable data concerning program outcomes which, in turn, can further promote environmental education.

The advantages of evaluation sound good in theory, but what about practice? Are the school programs of nature centers being comprehensively designed and evaluated? The following was designed to seek the answers to these questions.

2. Study Design

To ascertain the importance nature center educators place upon evaluation and comprehensive program design, six centers with school programs were selected as case studies. Five centers were chosen on the basis of their established reputations -- the Aullwood Audubon Center and Farm in Dayton, Ohio; the Chippewa Nature Center in Midland, Michigan; the Cincinnati Nature Center in Cincinnati, Ohio; the Kalamazoo Nature Center in Kalamazoo, Michigan; and the Shaker Lakes Regional Nature Center in Cleveland, Ohio. The sixth center, the relatively new Dahlem Environmental Education Center in Jackson, Michigan, was selected because of its commitment to include evaluation in the program design process from the onset.

Interviews with the nature center directors or program coordinators included these questions.

1. How did you decide what type of school program was needed in your community?
2. When you began to develop your program, what type of goals and objectives did you find it necessary to prepare?
3. What steps did you take in designing your school program?
4. Of what does your school program consist?
5. Who comprises your school program staff (e.g., volunteers or paid naturalists) and how do you train them?
6. How do you evaluate your program?

The purpose of questions 1, 2, and 6 was to determine whether or not a needs assessment, the setting of goals and objectives, and evaluation comprise a part of each center's program development process. Question 3 seeks information regarding the program development process followed at each center, question 4 a description of the current school program, and question 5 staff information.

3. Results

Information resulting from the case studies is included below. It includes what nature center personnel are currently evaluating as well as how evaluations are being conducted.

What	How
-student/teacher satisfaction	* general questionnaires * a record of the number of participants * return rate of the same schools and teachers * unsolicited comments * increased family memberships or summer camp registration
-staff satisfaction	* an in-house self-evaluation report * informal discussion between the program coordinator and the staff * mandatory staff/volunteer

	discussions at the conclusion of each field trip
-student learning	* pre- and post-testing * specific questionnaires designed to measure the mastery of each program option's performance objectives
-volunteer performance	* formal observation by a staff member
-the meeting of school program goals and objectives	* annual staff retreat
-program quality	* professional external review
-pre- and post-trip teaching materials	* the inclusion of teacher committees in the creation of these materials

While all six centers employ some of the components of comprehensive program development -- needs assessment, establishment of goals and objectives, systematic design, staff training and evaluation -- only two seem to employ them all. The fact that these two centers also put the most effort into evaluation exemplifies the practicality of incorporating evaluation into the program development process. Since a minority of case study centers do so indicates that insufficient evaluation may be occurring at nature centers across the country.

A Program Development and Evaluation Model for the School Programs of Nature Centers and Other Instructional Programs

I. The Pre-Instructional Phase
  A. Form an Education Committee.
    1. Conduct a needs assessment.
    2. Target the audience.
    3. Conduct a resource inventory.
  B. Formulate Program Philosophy and Concepts
  C. Select Program Option Titles.
  D. Set Goals and Objectives.
    1. For the overall program.
    2. For each program in the cognitive, affective, and skill domains.
  E. Create a Scope and Sequence Chart.
  F. Design Each Program to Include:
    1. A packet of pre- and post-trip activities.
    2. A field trip.
  G. Advertise the School Program.
  H. Conduct Staff Training.
  I. Intiate a Summative Evaluation Plan.
II. The Instructional Phase
  A. Pilot the Program.
  B. Conduct Formative Evaluation.
III. The Post-Instructional Phase

A. Conduct Summative Evaluation.
B. Prepare an Evaluation Report.
C. Revise the Program.
D. Set New Goals and Objectives and Plug Back Into Phase I.

The solution to the problem of inadequate evaluation requires the demystification of evaluation so that its full benefits can be achieved by the practitioner. The importance of environmental education demands that educators attempt, to the best of their abilities, to improve environmental education programs through the use of evalaution. Such efforts can only contribute to better solutions of the environmental problems facing us.

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Wolanin, Janet L. 1983. A Program Development and Evalution Model Derived From Nature Centers With School Programs. University of Michigan Master's thesis.

Paper Number 71

Wong, Sylvia J. "Conservation Information Through the Soil Conservation Service (SCS) and the Soil and Water Conservation District (SWCD): How Effective are the Lines of Communication?" The Ohio State University, Columbus, Ohio 43201.

During March and April of 1983, three counties in southwest Ohio were the subject of a study designed to evaluate the effectivess of communication forms used by the SCS and SWCD to inform farmers about conservation. The evaluation and recommendations which resulted from this study are based on the responses gathered from two surveys; one distributed to 11 SCS and SWCD personnel, and one distributed to 195 randomly chosen farm owners and/or operators from the three counties.

The surveys distributed to the SCS and SWCD, and to the farm owners/operators were designed such that their results could be compared and contrasted. Agency personnel were perceived by the writer as the "sender" of information, while the owners/operators of farms were perceived as "receivers" of information. With this in mind, the surveys were designed to determine: 1) what types of communication were being used by the agencies and received by the farmers, 2) the perceived effectivensss of those communication forms, both from the agency's and the farmers'standpoint, 3) the frequency of use for each communication form, and 4) the credibility of each communication form. Special emphasis was placed on mass media (television, radio, newspapers, and magazines) as a source of conservation information, in order to determine the current extent of its use, as well as its potential for future use.

The results of the two surveys will be compared for each individual county in order to provide an evaluation of the current communication efforts of each agency and to provide recommendations for future programs. In addition, the responses from all three agencies will be compared with the responses of the farmers in all three counties in order to gain a more general picture of the kinds of information programs sponsored by the SCS and SWCD, and their effectiveness.

Paper Number 72

Yaple, Charles H. "The Christian Church and Environmental Education." State University of New York at Cortland, New York 13045.

During the past five years an increasing number of authors have written about environmental ethics and the need for an ecological conscience to permeate our society. Indeed, a survey of environmental literature reveals several texts and even a periodic journal dedicated to the theme of environmental ethics. Yet, little information can be found pertaining to the role of a traditional societal guardian of American ethics, namely the Christian Church. The following abstract reveals the findings of a five year study of the Christian Church and its past, present, and potential involvements with environmental education.

The four-fold objectives of the study were to: 1) analyze the central tenets of Christianity and determine if they obligate the Church to be involved with environmental education, 2) determine the shape of church involvement with conservation and environmental matters prior to the first Earth Day, 3) determine the present scope of church involvement with environmental education and, 4) analyze the opinions of church professionals and environmental educators towards future church involvements with environmental education. Space limitations of this abstract do not allow detailed explanation of all study findings. Consequently, only a synopsis of findings for objectives one through three is provided with more thorough attention given to the fourth objective concerning future church involvements with environmental education.

In order to address the first objective, a thorough analysis of the Biblical foundations of Christianity was conducted. Findings suggested that old and new testament themes of: a) stewardship, b) faith in God as both sovereign creator and savior and, c) God's plan for unity between himself, humankind, and nature do obligate the Church to be actively involveed in preserving the earth.

The second study objective was accomplished through documentary analysis. Findings indicated that the spirit of capitalism, fueled by the Protestant Reformation and the advent of the Industrial Revolution, engulfed not only the minds of Americans in the 18th and 19th centuries, but their churches also. Thus, the Church played little part in the conservation movement of the early 1900's or in the rise of environmentalism in the 1960's. Religious concern for the environment found some expression in the writing and activities of inspired individuals such as Thoreau, Muir, and others.

Study objective three, pertaining to present church involvement with environmental education, was completed through development and administration of a mail questionnaire survey and documentary analysis. The survey instrument collected data pertaining to church involvement with environmental education in terms of "educational program emphasis," "direct work with environmental problems," and "allocation of resources committed to environmental education." Subjects selected were regional and national church officers whose positions were likely to make them familiar with the environmental activities of their denominations. Church denominations participating in the survey were The American Lutheran Church, The Episcopal Church, The Roman Catholic Church, The Southern Baptist Convention, The United Methodist Church, and the United Presbyterian Church.

Survey results revealed that environmentally-related issues receiving most attention through church educational programs were world hunger, lifestyles, land stewardship, conservation of energy, and environmental ethics. Use of the printed word was the most popular form of addressing these issues. Direct programmatic outreach efforts were most apparent with world hunger and lifestyle education endeavors. Personnel and monetary resources allocated to environmental education were not substantial and appeared to be assigned on a "special need" basis although one denomination has created a national office of Environmental Justice and Survival. Clergy received training in environmental matters primarily though incidental exposure in various seminar courses.

The final study objective related to the opinions of church professionals and environmental educators towards the role of the Church with environmental education. The objective was addressed through the development and administration of a nationwide mail opinionnaire survey. Subjects were 739 randomly selected members of the Conservation Education Association (CEA), National Association for Environmental Education (NAEE), Religious Education Association (REA) and chief executive church officers (Bishops, etc.) identified from the directories of the six church denominations participating in the study. Subjects were asked to respond to a series of Likert-scale type statements concerning church relationships with environmental education. Data gained from a overall response rate of 64 percent were subjected to statistical testing utilizing the chi-square test of significance and Cramers V test of association. Significance was established at the .05 level of confidence.

Results of the opinionnaire survey (See Tables 1 and 2) indicated that subjects were quite positive in most cases about the Church being involved with environmental education. Of the four groups surveyed, Church officers, followed by subjects from the REA, NAEE, and CEA, were most supportive of church involvement. Environmental issues receiving strongest support for church involvement were world hunger, land stewardship, environmental ethics, population, lifestyles, and nuclear energy.

Questioned as to specific ways in which the Church should be involved with environmental education, subjects were most supportive of ways that did not involve the Church in complex technological matters. Strongest agreement among subject groups was for the Church to: a) be involved with teaching environmental responsibility, b) provide environmental training in seminary schools, c) be active in community environmental education, and d) to make public position

Table 1. Compasison of Agreeing Opinions Towards Statements Concerning Church Involvement With Environmental Matters.[1]

Statements	REA[2] %	CHURCH OFFICERS %	CEA[2] %	NAEE[2] %
1. Part of the mission of the Church should include a concern for the teaching of environmental responsibilities.	98.5	99.1	91.6	99.1
2. See Table 2 for statement #2.				
3. The Church should make advocacy or public position statements concerning environmental problems.	85.1	90.6	63.8	74.6
4. The Church should be concerned with the technological, economical, and political aspects of environmental problems as well as the moral/ethical consideration.	84.5	79.6	42.6	72.8
5. The Church should write and publish educational materials concerning environmental issues.	80.1	85.3	65.5	73.1
6. Church staff should actively participate in community environmental education.	79.4	84.6	79.6	80.0
7. The Church should employ at the national or state/regional level, professional environmental education resource people.	48.5	38.5	53.3	67.1
8. Seminaries or clergy training schools should provide instruction which relates religious and environmental issues.	89.6	93.2	86.6	91.4
9. Public schools should be most responsible for environmental education.	57.9	69.3	83.4	61.1

1. Figures are a composite of "Strongly Agree" plus "Agree" categories for each group.

2. REA (Religious Education Association); CEA (Conservation Education Association), NAEE (National Association for Environmental Education).

Table 2. Comparison of Agreeing Opinions Towards Church Involvement With Environmental Issues.[1]

Statement 2 The teachings of the Church should deal with the following issues:	REA[2] %	CHURCH OFFICERS %	CEA[2] %	NAEE[2] %
World Hunger	99.5	99.1	95.0	96.4
Solid Wastes	78.6	78.9	62.0	68.8
Toxic Substances	81.8	87.8	61.4	72.5
Air Pollution	87.1	89.6	63.8	71.3
Noise Pollution	80.4	77.0	62.0	63.8
Nuclear Energy	92.8	95.7	61.1	72.6
Conservation of, or Alternative Energies	88.6	91.4	75.0	80.1
Land Stewardship, Preservation of Natural Resources	92.8	99.2	95.1	96.4
Endangered Species	76.0	72.1	72.4	84.4
Population	91.8	93.9	81.9	90.2
Environmental Ethics	95.9	92.2	93.4	97.5
Water Pollution	88.6	90.3	67.2	75.1
Urban Environmental Planning	82.5	83.5	62.1	67.6
Life Styles	91.2	91.0	77.6	89.1

1. Figures are a composite of "Strongly Agree" plus "Agree" categories for each group.

2. REA (Religious Education Association), CEA (Conservation Education Association), NAEE (National Association for Environmental Education).

statements on environmental problems.

The preceding suggests considerable interest in environmental education by members of the clergy, church officiers, and religious educators. Environmental groups would do well to remember recent research findings concerning the power of the clergy to influence people. "For the fourth time in a row, a national survey has shown that members of the clergy are ranked highest among professional groups in terms of 'honesty and ethical standards' by the American public" (Dunham, 1981). The importance of that finding by the George Gallup polster organization is that clergy, if fully educated and motivated, could be valuable community environmental education teachers. Muth and Hendee (1980) found, in their research on "Technology Transfer and Human Behavior" that:

> ...the flow of new information in any social system is not random. Certain individuals are sought out for information, opinions, and suggestions about many things, and it is by them that innovations are most effectively diffused throughout a social system. But only a few key people in a community have such influence.

Robert Roth of the Ohio State University in writing about the aims of environmental education explained that they must include concern for developing a citizenry that is:

1) knowledgeable about the complex interrelationships of the biophysical and sociocultural environments;
2) aware of both the associated environmental problems and alternatives for solving those problems; and
3) motivated or committed to working toward solving environmental problems in such a way as to create environments that are optimal for living (Roth, 1971).

Much effort has already been expended by educators trying to implement items one and two. However, without "motivation or commitment" from a majority of the citizenry all the legislation, technology, and education in the world will fail short of ensuring an earth capable of sustaining life for its inhabitants. How, and from what source(s), can the ingredients of motivation and commitment be obtained?

This author's main thesis is that the Christian Church, as a shaper of human behavior, can and should play an important role in promoting motivation and commitment for the resolution of environmental problems and the evolution of creative environments that are optimal for living. If it attends in a serious, vigorous, and systematic fashion to the implications of its central symbols and the findings of environmental science, the Church may significantly assist in bringing about the aims of environmental education as outlined by Roth.

The task confronting those interested in furthering environmental education entails the involvement of all groups and institutions within society that can help, as paraphrased from Lynton Caldwell, internalize an ecological conscience in a critical mass of humankind, (Caldwell, 1980). The Church and other religious groups are likely sources of assistance in bringing about "ecological conscience" and need to be included in planning environmental futures. Perhaps it is time for an environmental organization, such as the National Association for Environmental Education, to consider the creation of a section on Religion, Ethics, and Philosophy within its ranks.

One assignment for the new section could be the establishment of a special task force charged with exploring ways of interfacing with organized religion. As a beginning, the task force might be charged with encouraging various religious organizations to affiliate with the National Association for Environmental Education (NAEE). The considerable concern for environmental education expressed by members of the Religious Education Association, in the study described earlier, suggests that organization as a potential candidate.

Recent completion of an exhaustive study of its mission perspective has prompted the 32 Protestant and Orthodox denomination National Council of the Churches of Christ in the U.S.A. (NCCC) to be "more pluralistic in the way it extends its compassion and services," (Pohl, 1983). A powerful force in the civil rights movement of the 1960's, the NCCC may now be receptive to actively supporting environmental education endeavors. The time seems opportune to solicit the NCCC as an environmental education ally.

A step in exploring the potentiality of the suggested affiliations could take the form of a working conference between interested members of NAEE and religious leaders identified from this author's study. One task for the conferees should be the formulation of a set of resolutions prescribing future cooperative efforts recognizing that the human spirit is inextricably intertwined with environmental problems. Until the spiritual dimension is adequately addressed we will continue only to nibble away at the edges of reoccurring environmental dilemmas.

Paper Number 73

Zeph, Paul T. and Abby Burns. "Environmental Education on the Road Again." Aullwood Audubon Center and Farm, Dayton, Ohio 45414.

1. Introduction

As school funding cutbacks reduce student visitation to environmental education centers, many facilities are developing programs to bring nature into the classroom. The Aullwood Audubon Center and Farm has recently developed and tested two innovative in-school programs for first through third grades. These fifty minute programs, entitled "The Magic Soil" and "Endangered Animals," go beyond the more typical in-class program (i.e., slideshows or animal show-and-tell) by incorporating some of the more recently developed educational techniques and learning tools.

2. Program Strategies

A prerequisite to developing a successful program is to know the learner. We first researched how first, second, and third graders' minds work, then included the following strategies in our program:

The use of fantasy -- children at this age constantly use their imagination, and create experiences as they begin to make sense of the world around them.

Concrete learning -- children need visual images to make abstract concepts more understandable.

Involvement -- students remain tuned in better to what is being presented, and thus learn better when actively involved in the program.

Reversability -- cognitive development in lower elementary students can be promoted by presenting sequences forward, then in reverse.

In addition to utilizing the most appropriate strategies for the target group, our goal was to also emphasize the affective domain to develop a positive feeling or attitude in the students about the topics presented.

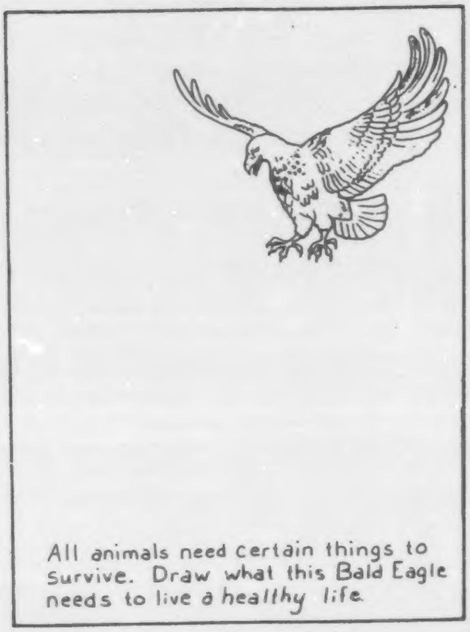
3. Educational Techniques

These two programs utilize a variety of educational techniques -- some common to both and others unique to one program or the other. The predominent technique used in both programs is creative dramatics. This is a little used teaching tool in today's formal education, but one that can be extremely powerful in helping students conceptualize and internalize the presented material. We were inspired to use this as a central vehicle from the work of Michael Weilbacher. The entire class is used throughout each program for sound effects and acting out situations, while individual class members are brought forward periodically to role play specific parts. For the individuals who portray animals, we use simple costume hoods to assist and help visualize the role playing. Children enjoy this form of learning, tune out less when actively involved, and, as a result, often learn better as a participant in the learning process. We view this as an important, exciting teaching strategy for environmental as well as all education.

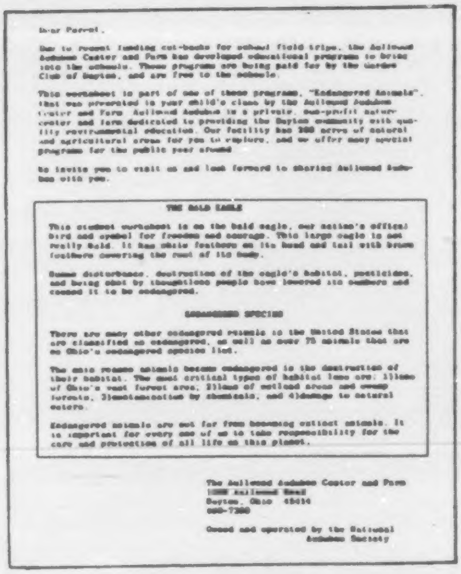
Another technique common to both programs is the use of a student coloring page, in the form of the Imagination Books developed by Donna Szuhy, which serves to reinforce the concepts presented and to provide an opportunity for the student to actively retell what is learned (See Figures 1 and 2). On the back of these worksheets is a message to parents about the Aullwood Audubon facility and what we are doing in their child's school. Below this is a simple environmental education message to the parent about soil or endangered animals.

Figure 1: Student Coloring Pages

"Endangered Animals"



All animals need certain things to survive. Draw what this Bald Eagle needs to live a *healthy* life.



Dear Parent,

Due to recent funding cut-backs for school field trips, the Aullwood Audubon Center and Farm has developed educational programs to bring into the schools. These programs are being paid for by the Garden Club of Dayton, and are free to the schools.

This worksheet is part of one of these programs, "Endangered Animals", that was presented in your child's class by the Aullwood Audubon Center and Farm. Aullwood Audubon is a private, non-profit nature center and farm dedicated to providing the Dayton community with quality environmental education. Our facility has 200 acres of natural and agricultural areas for you to explore, and we offer many special programs for the public year around.

We invite you to visit us and look forward to sharing Aullwood Audubon with you.

THE BALD EAGLE

This student worksheet is on the bald eagle, our nation's official bird and symbol for freedom and courage. This large eagle is not really bald. It has white feathers on its head and tail with brown feathers covering the rest of its body.

Human disturbance, destruction of the eagle's habitat, pesticides, and being shot by thoughtless people have lowered its numbers and caused it to be endangered.

ENDANGERED SPECIES

There are many other endangered animals in the United States that are classified as endangered, as well as over 75 animals that are on Ohio's endangered species list.

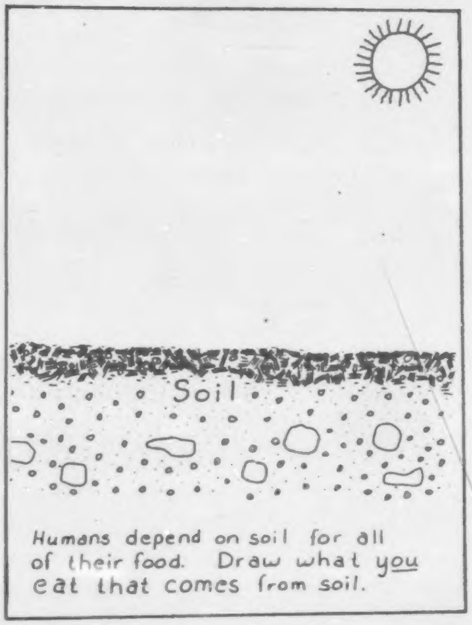
The main reason animals become endangered is the destruction of their habitat. The most critical types of habitat loss are: 1)loss of Ohio's vast forest area, 2)loss of wetland areas and swamp forests, 3)contamination by chemicals, and 4)damage to natural waters.

Endangered animals are not far from becoming extinct animals. It is important for every one of us to take responsibility for the care and protection of all life on this planet.

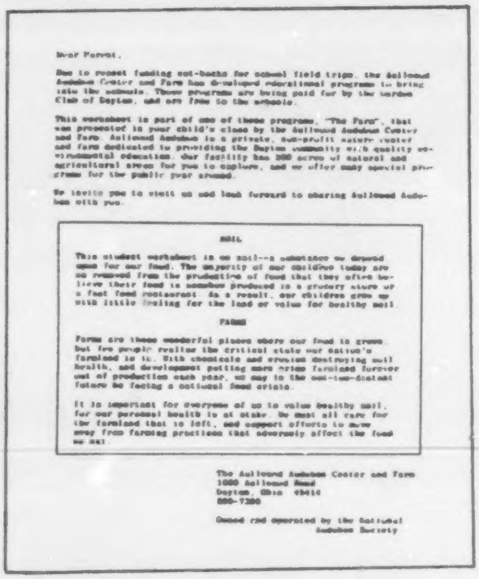
The Aullwood Audubon Center and Farm
1000 Aullwood Road
Dayton, Ohio 45414
890-7360

Owned and operated by the National
Audubon Society

"Magic Soil"



Humans depend on soil for all of their food. Draw what you eat that comes from soil.



Dear Parent,

Due to recent funding cut-backs for school field trips, the Aullwood Audubon Center and Farm has developed educational programs to bring into the schools. These programs are being paid for by the Garden Club of Dayton, and are free to the schools.

This worksheet is part of one of these programs, "The Farm", that was presented in your child's class by the Aullwood Audubon Center and Farm. Aullwood Audubon is a private, non-profit nature center and farm dedicated to providing the Dayton community with quality environmental education. Our facility has 200 acres of natural and agricultural areas for you to explore, and we offer many special programs for the public year around.

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SOIL

This student worksheet is on soil--a substance we depend upon for our food. The majority of our children today are so removed from the production of food that they often believe their food is somehow produced in a grocery store or a fast food restaurant. As a result, our children grow up with little feeling for the land or value for healthy soil.

FARMS

Farms are those wonderful places where our food is grown, but few people realize the critical state our nation's farmland is in. With chemicals and erosion destroying soil health, and development putting more prime farmland forever out of production each year, we may in the not-too-distant future be facing a national food crisis.

It is important for everyone of us to value healthy soil, for our personal health is at stake. We must all care for the farmland that is left, and support efforts to move away from farming practices that adversely affect the food we eat.

The Aullwood Audubon Center and Farm
1000 Aullwood Road
Dayton, Ohio 45414
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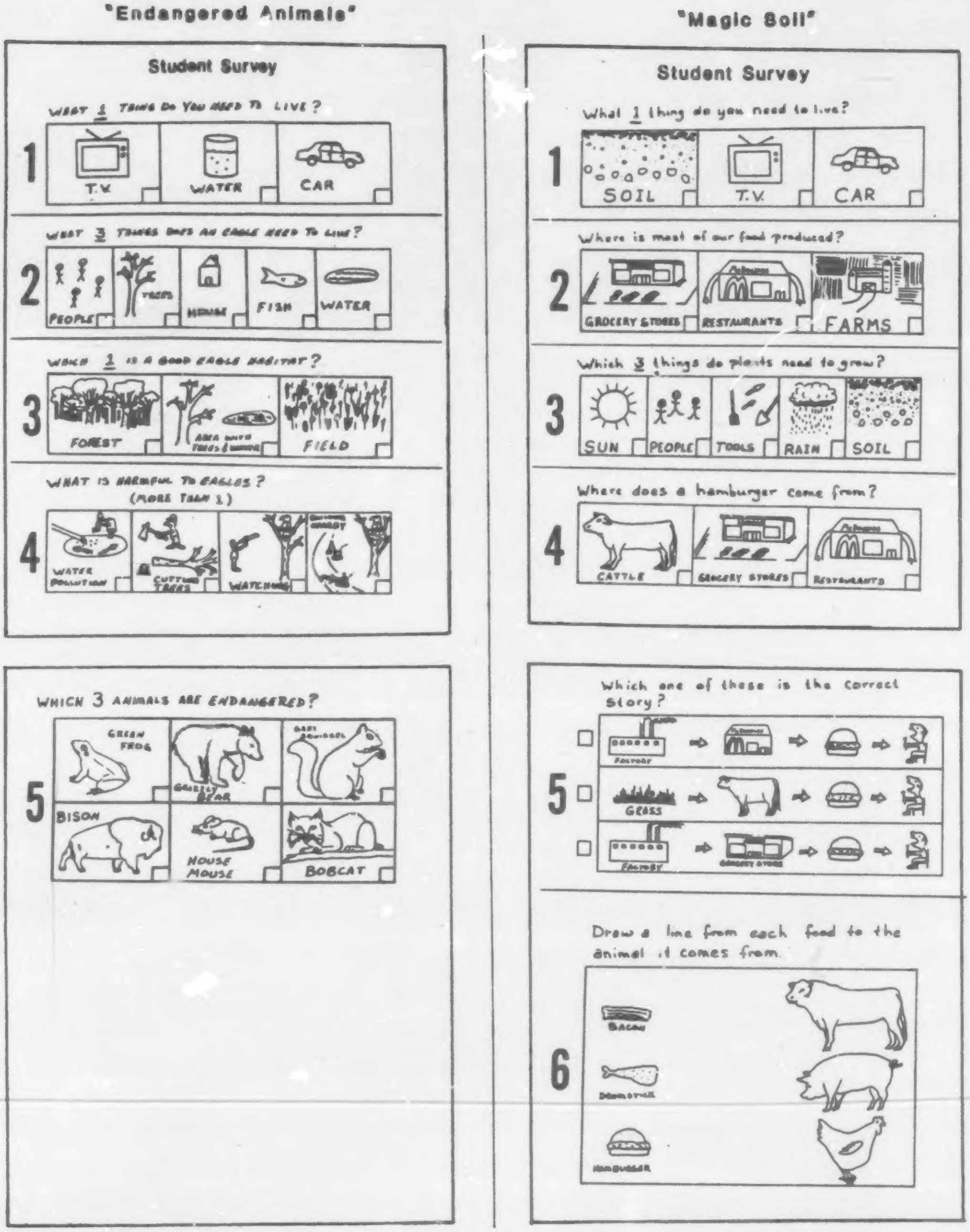
Figure 2: Pre-Post Test



"Endangered Animals"

Student Survey

1 WHAT 1 THING DO YOU NEED TO LIVE?

T.V. ☐ WATER ☐ CAR ☐

2 WHAT 3 THINGS DOES AN EAGLE NEED TO LIVE?

PEOPLE ☐ TREES ☐ HOUSE ☐ FISH ☐ WATER ☐

3 WHICH 1 IS A GOOD EAGLE HABITAT?

FOREST ☐ AREA WITH TREES & WATER ☐ FIELD ☐

4 WHAT IS HARMFUL TO EAGLES?
(MORE THAN 1)

WATER POLLUTION ☐ CUTTING TREES ☐ WATCHING ☐ ☐

5 WHICH 3 ANIMALS ARE ENDANGERED?

GREEN FROG ☐ GRIZZLY BEAR ☐ ☐

BISON ☐ HOUSE MOUSE ☐ BOBCAT ☐

"Magic Soil"

Student Survey

1 What 1 thing do you need to live?

SOIL ☐ T.V. ☐ CAR ☐

2 Where is most of our food produced?

GROCERY STORES ☐ RESTAURANTS ☐ FARMS ☐

3 Which 3 things do plants need to grow?

SUN ☐ PEOPLE ☐ TOOLS ☐ RAIN ☐ SOIL ☐

4 Where does a hamburger come from?

CATTLE ☐ GROCERY STORES ☐ RESTAURANTS ☐

5 Which one of these is the correct story?

☐ FACTORY → → →

☐ GRASS → → →

☐ FACTORY → GROCERY STORE → →

6 Draw a line from each food to the animal it comes from.

BACON

DRUMSTICK

HAMBURGER

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Educational techniques that are specific to the "Magic Soil" program include: 1) the use of magic with a "magic cloth" and "magic soil" which serves to heighten the young students' interest from the beginning; 2) the use of a short slideshow of farm and farm animals with simple lively music to allow for passive absorption of concepts; 3) building a food chain (using students) from hamburger to soil, and backwards from soil to hamburger (reversability) to increase concept retention and promote the students' cognitive development toward Piaget's concrete-operational stage; and 4) a closing group song to thank soil, this affecting our goal of positive attitude development by having students verbalize that soil is special.

In the "Endangered Animals" program, the topic is beyond the immediate experience of first through third graders, so a series of links are used to make the needs of endangered animals more concrete. The use of a dog hand puppet provides an animal to which all of the children can relate, and whose needs they can discuss. Basic animal needs of food, water, and shelter are then extended to animals living in a park near the students' school; which then leads to the habitat of the bald eagle -- an endangered animal that the children all have some familiarity with. After some of the students build park animal and eagle habitats, other students destroy the habitats as tree choppers, water polluters, etc. Varying techniques such as inculcations about the value of life, clarification about the destruction, and moral dilemmas about what to do next are incorporated. At the end of this program, again a song is used for attitudinal development. In this case, the song is used to help "get in touch wih the eagle spirit," and to leave the children with positive feelings toward an endangered animal.

4. Paying for the Program

We chose first through third graders as our target group for there are few programs available for the lower elementary. We would, therefore, be meeting a community need. We also would be reaching inner city schools with the program -- a group that usually cannot afford many field trips and often doesn't receive much environmental education. These two aspects of the program made it highly saleable for grant funding, and the Dayton Garden Club funded the program for an initial two year period. This grant paid for the development of script, props, and for mileage to bring the program to schools throughout the Dayton area, and $1.00 for each student reached in the two years.

5. Evaluating the Program

Several methods were utilized to evaluate the program. A pre/test was developed to evaluate student changes, and a teacher evaluation was used to obtain feedback from all teachers observing the program.

Development of the pre/post test required careful thinking, for we were trying to test a group that could not yet read or write. The result was an instrument of four to six questions which the teacher would read. After each question were a series of pictures to correspond with possible answers to the question, with a small box in each picture for students to mark, indicating their answer. The results of the first year's testing indicate substantial growth in some classes, and less growth in others; although the data has not as yet been statistically analyzed for significance.

The teachers felt both the soil and endangered animals programs were excellent, fit perfectly with the first through third grade curriculum, and were an exciting way to present potentially mundane material. The teachers were especially emphatic about the benefits of the children participating in the program. In the words of one teacher regarding the endangered animals program, "the children really liked the concrete examples of trees, houses, lakes, and being able to participate in the lesson; children love to act out anything!"

In asking the students how they liked the program and what they learned, some responses were:

The Magic Soil

"Loved it, better than the movies."
"Surprised that most food comes from soil."
"It was funny and fun to listen to, it had a lot of humor."
"No rain, no food -- we're all part of the soil."
"Soil can really be precious."

Endangered Animals

"Lots of fun, can we do it again?"
"Playing the parts, wearing the masks."
"Feel sorry when animals died."
"Everyone should take care of animals, shouldn't chop down trees and destroy ponds."
"Eagles won't eat dead fish, there are not very many eagles left."

6. The Programs

"The Magic Soil" This program introduces the concept of soil and its importance for producing all of our food. A seed is planted in a box of "magic soil;" and, with the help of the audience in making rain noises and acting out the shining sun, assorted vegetables and finally a hamburger are pulled from the soil: "A hamburger from the soil?" says one staff to the other, "The next thing you're going to tell me is that everything we eat comes from the soil!" "Well it's true," says the other, "I'll prove it to you!" Children are brought up to become a hamburger, a piece of bacon, and a drumstick. With the help of the magic cloth as a curtain, these foods become a cow, a pig, and chicken using simple hoods. two more students become food for the animals -- grass and corn. The animals eat as the audience provides munching noises. The other staff now proves she understands, brings up a student to be soil, and plants grass and corn students as seeds of those plants. With the class reinacting rain and sun, the seeds grow into mature plants, the animals return to eat, and the audience again makes munching noises. The animals now go behind the magic cloth (this time, cloth has a "market" sign on it), and come out as the food that comes from that animal.

To this point, the students have witnessed and participated in a food chain from meat to soil, then that same food chain reversed from soil to meat. They have also experienced other lower elementary basics such as the needs for plant growth (soil, rain, sun), animal sounds, and which meats come from which animals.

With the entire class back in their seats, a slideshow is shown of a farm with bluegrsss music and animal sounds. The lights go on and one staff reviews what she learned: "Everything we eat comes from the soil; so we are a part of the soil; and we must care for our soil." The staff bow and thank the soil, then a song is sung with the class so they can also thank the soil. The coloring sheet is then handed out for the students to color in class, then take home.

"Endangered Animals" This program begins with a dog hand puppet with which the basic needs of animals are determined -- food, water, and shelter. A park nearby the students' school is then reconstructed in the classroom with trees, grass, rocks, water, and houses nearby. Students become animals that live in the park by putting on hoods to become a snake, bird, rabbit, fish, and a child baseball player. These animals sit quietly in the park while the rest of the class takes a hike into a wilderness area. There a habitat is seen with tall trees, a lake, fish, and a large nest in one of the trees. This habitat is constructed with props as it is described, then in comes a staff dressed as an eagle. The eagle checks its nest, eats a fish, then flies out of the room. Students are then brought up and assigned parts: tree choppers, bulldozer driver, polluters; while the audience chooses noise to make: chop, chop -- rrr, rrr -- saw, saw -- or trash, splash. The audience makes noise while destroyers chop or bulldoze, etc. After everyone is sitting down, The eagle returns and surveys ruins, tries to eat a dead fish, finds fallen trees and nest, and can't live here anymore. The eagle slowly dies, and staff takes off the eagle costume. This person then discusses what happened and the eagle as an endangered animal. Other endangered animals are discussed with posters to visualize animals.

The focus then returns to the park that was built earlier. Staff discusses with the class what could happen to the park, and what would happen to the animals that live there if the park was destroyed for parking lots or development. Various parts of the park are removed and the student-animals must decide where to go and if they will be able to survive.

The focus again returns to the destroyed eagle habitat. The class discusses if anything could be done to make the place habitable for eagles again. As students suggest planting trees, restocking fish, or cleaning up pollution, they do the cleaning or stocking or planting. A final measure would be to protect this place from future destruction -- a student comes forward and holds up an "animals protected" sign. A group song is then sung to the eagle spirit to help all animals in danger; then the coloring sheet is handed out to the students.

7. Final Remarks

The two programs described in this paper are examples of alternatives available for in-school programs. In contrast to more traditional environmental education, they incorporate a variety of educational techniques and strategies designed to hold the attention of the learner through participation, thus providing a more meaningful educational program. In addition, these programs are extremely rewarding and a lot of fun to perform. It is hoped that some of the ideas presented here will be considered in the development of future programs. Additional program details and scripts for the two programs presented here are available upon request from the authors.